# Erie-Niagara Basin

## Chemical Quality Of Streams

ERIE-NIAGARA BASIN REGIONAL WATER RESOURCES PLANNING BOARD

THE NEW YORK STATE WATER RESOURCES COMMISSION

CONSERVATION DEPARTMENT • DIVISION OF WATER RESOURCES

ENB-4

# CHEMICAL QUALITY OF STREAMS IN THE ERIE-NIAGARA BASIN, NEW YORK

**Prepared for the**
**Erie-Niagara Basin Regional Water Resources**
**Planning Board**

**by**

**R. J. Archer, A. M. La Sala, Jr., and J. C. Kammerer**

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
in cooperation with
THE NEW YORK STATE CONSERVATION DEPARTMENT
DIVISION OF WATER RESOURCES

**STATE OF NEW YORK**
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# ACKNOWLEDGMENTS

This report has been prepared for the Erie-Niagara Basin Regional Water Resources Planning Board under the general guidance of Mr. R. C. Heath, former District Chief and his successor Mr. G. G. Parker both of the United States Geological Survey's Albany, New York District Office.

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# CHEMICAL QUALITY OF STREAMS IN THE ERIE-NIAGARA BASIN, NEW YORK

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R. J. Archer, A. M. La Sala Jr., and J. C. Kammerer

# ABSTRACT

The streams in the 2,000-square-mile Erie-Niagara basin of western New York contain mainly a calcium bicarbonate type of water whose dissolved-solids content generally varies between 140 and 240 ppm (parts per million). Water "hardness" (expressed as $CaCO_3$) is usually between 100 and 200 ppm, sulfate concentrations are between 20 and 60 ppm, and chloride between 5 and 20 ppm. The higher concentrations of these constituents and properties are representative of the northern part of the area, which is underlain by the gypsum-bearing Camillus Shale. The northern part of the area contains a predominantly calcium sulfate type of water that usually has a dissolved-solids content of between 250 and 750 ppm, sulfate between 40 and 350 ppm, chloride between 20 and 70 ppm, and hardness between 200 and 500 ppm.

The dissolved-mineral content of shallow ground water is the principal influence upon the chemical quality of the streams, except during and soon after periods of dilution by heavy precipitation or snowmelt. The average dissolved-mineral content of precipitation is about 35 ppm of dissolved solids, but substantially higher concentrations, as much as 327 ppm, have occurred. These high concentrations are attributed to industrial air pollution in the Buffalo area.

The report contains chemical analyses of more than 700 samples collected mainly during 1963 and 1964, including samples of precipitation and overland flow. Utilizing these data, maps and graphs show significant regional and time variations in the natural water quality.

# INTRODUCTION

The purpose of this report is to describe the chemical quality of water in streams in the Erie-Niagara basin, including the variations from place to place and from time to time. Emphasis is largely on the "natural" quality of water, unaffected or but little affected by man's activities. The many chemical analyses made during the project, mostly in 1963 and 1964, are presented in full (mainly at the end of the report) along with illustrations and summary tables that are intended to make the report as readily usable and understandable as possible to water users, planners, and managers.

Conclusions are drawn, not only about the types of water in the area, but also about the reasons for its quality, that is, why does one water contain more dissolved mineral matter than another, and why and in what manner does this quality vary in place and time? From a knowledge of the causative factors and their relative influence, the local and regional situations become more fully understood and apparent, and reasonable assumptions can be made of the chemical quality of streams even where the quality has not been determined by laboratory analyses.

The New York State Health Department made studies on the sanitary quality of streams a part of its work for the Board. With few exceptions, the reaches of streams known to receive large quantities of municipal and industrial wastes have not been sampled by the Geological Survey, because of changes in natural chemical quality occurring as a result of the effluent discharge. Therefore, stream pollution is mentioned only briefly in this report.

The preparation of this report on chemical quality of streams has been concurrent and closely coordinated with associated Geological Survey reports on ground water (LaSala, 1968), on the flow of streams (Harding and Gilbert, 1968), and on fluvial sediment (Archer and LaSala, 1968). These three reports have been freely drawn upon for information on the quality of ground water, the magnitude and variations in the flow of streams, and the discharge of ground water to streams. The reader is referred to them for more detailed data on those subjects.

Sampling sites referred to in this report are numbered under several systems according to the types of samples. These systems are explained in Appendix A, "Numbering System for Sampling Sites." The basic data tables (tables 14 to 25) in Appendix B list the detailed results of the chemical analyses and a cross index of the sampling points.

# SCOPE OF CHEMICAL-QUALITY STUDY

This study has been directed entirely toward collecting and evaluating water-quality information about the streams of the region, even though thousands of people and many industries depend upon Lake Erie rather than local streams for their water supply, especially in Buffalo and adjacent areas. The point is that many of the quantity and quality characteristics of Lake Erie are generally well known (see for example New York State Dept. of Health, 1953), whereas such has not been the case for most of the local streams. Furthermore, economic considerations presently preclude distribution of water from Lake Erie to the central and eastern parts of the region. Water needs in these parts of the region will continue to be developed from inland sources, and the water-quality data in this report will aid in the development of these sources.

In order to gain a broad knowledge of the factors affecting the chemical quality of streams, the Geological Survey included in this study not only the sampling and analyzing of water in streams themselves, but also some chemical analysis of the "prestream" water environment -- that is, of rain and snow, the sources of water which eventually appear in streams. Some analysis was made also of overland flow -- water that flows over the land surface to the streams. From these analyses an assessment was made of the effect of precipitation and overland flow on the chemical quality of streamflow.

A major part of the time and effort of this study was devoted to sampling and analyzing streams at very high and very low flows, so as to define the range in quantity of mineral matter in the water from the most dilute concentrations to the most mineralized. In order that the extremes of chemical-quality values at times of very high and very low streamflow might represent region wide conditions at a selected time, a special effort was made to achieve as nearly a simultaneous sampling as possible throughout the area, within practical limits of cost and available manpower. Accordingly, most of the high-flow sampling was done during a period of thaw on March 4 and 5, 1964; and most of the low-flow sampling during a predominantly dry period of summer, on July 2, 4, and 5, 1963.

A summary of the types and magnitude of all chemical-quality data obtained for streams and for precipitation by the Geological Survey is shown in table 1. Plate 1 shows locations of all stream-sampling sites, and figure 3 shows locations of all precipitation-sampling sites. Locations of overland-flow sites are indicated in table 16.

Table 1.--Summary of kinds of samples collected, and types and number of chemical analyses tabulated in this report

Note: In the table below, a "partial" analysis includes determination of less than 12 constituents or properties, generally including some or all the following: $SO_4$, Cl, specific conductance, Ca or hardnesss, and pH; a "complete" analysis includes determinations of 12 or more constituents or properties which, in addition to those previously listed, generally include many or all the following: $SiO_2$, Fe, Mn, Mg, Na, K, $CO_3$, $HCO_3$, F, $NO_3$, dissolved solids (residue on evaporation), and color.

| Kind of sample collected | Number of sites | Number of analyses | | | | Table containing data |
|---|---|---|---|---|---|---|
| | | 1963-65 | | Prior years | | |
| | | Partial | Complete | Partial | Complete | |
| Precipitation (Mar.-Sept.,1963) | 7 | 105 | -- | -- | -- | 13 |
| Snow (mainly Feb. 17-18, 1964) | 59 | 71 | -- | -- | -- | 14 |
| Overland flow (mainly in Cattaraugus Creek basin Mar. 5 and 9, 1964) | 17 | 17 | -- | -- | -- | 15 |
| Streamflow | | | | | | |
| High flow (mainly Mar.4,5,9, 1964) | 134 | 163 | -- | -- | -- | 16 |
| Low flow (mainly July 2,4,5, 1963) | 163 | 174 | 32 | 1 | -- | 17,18 |
| Additional sampling, Occasional | 41 | -- | 1/ 56 | -- | 24 | 18 |
| Daily or 10-day composites | 2/ 4 | -- | -- | 34 | 89 | 19-22 |

1/ In addition to these 56 analyses, 32 other complete analyses are included in table 19, of samples collected on July 2 or 5, 1963, at a time of low streamflow; selected constituents from these 32 analyses are also given in the table of low-flow analyses (table 18).

2/ Includes 2 sites near, but outside of the Erie-Niagara basin.

# BRIEF LOOK AT CHEMICAL QUALITY OF STREAMS IN THE REGION

The water in streams in much of the Erie-Niagara basin is similar in chemical quality, at least in the total of dissolved mineral matter (between 150 and 500 parts per million), to that supplied by municipal water supplies to about 40 million people in the United States (Durfor and Becker, 1964b). The notable exception is the northern part of the area, principally in the Tonawanda Creek basin west of Batavia, where the quantities of dissolved mineral matter are much higher.

Tables 2 and 3 show some of the chemical characteristics typical of the region, a few of the streamflow characteristics, and physical and geologic characteristics of the four streams selected as examples; also included is a chemical analysis of Lake Erie or the Niagara River water for comparison. Although the stream sampling indicated by the two tables is limited to only four specific sites, each sample, in effect, represents a composite of the characteristics (of the chemical quality) of the entire stream basin upstream from that site. The locations of these four streams and sites are shown in figure 1 as well as in plate 1.

The data in table 2 are typical of median conditions in each stream listed, whereas table 3 includes also some information on chemical quality of the water during times of very high (in three of the streams) and low flow (in all four streams). The data shown for Cayuga Creek and Little Tonawanda Creek represent conditions in the greater part of the Erie-Niagara basin (much of the Cattaraugus Creek basin has only slightly less mineralized water); the Tonawanda Creek and Ellicott Creek sites show the more highly mineralized water of the lower Tonawanda Creek basin. The wide variations in quality shown in the tables are caused mainly by geologic factors, which are discussed in later sections of this report.

For purposes of convenient comparison, tables 2 and 3 also contain chemical data on the largest source of water available to the region, Lake Erie. (The Niagara River water at Niagara Falls is Lake Erie water after it has moved only some 10 to 15 miles downstream from the lake.)

Table 4 compares three chemical characteristics at upstream and downstream sites on seven of the largest streams in the basin during low streamflow, and at most of these same sites, at very high flow. Note that the greatest contrasts in quality, with respect to both upstream-downstream changes and high flow-low flow changes, occur on Tonawanda and Ellicott Creeks.

Table 2.--Chemical analyses of water at times of moderate flows, in four representative streams, 1963; and of Lake Erie water at Buffalo, Aug. 22, 1961

(All chemical results in parts per million, unless otherwise noted)

| Stream site number: USGS<br>N.Y.State | 2150<br>E1-6(11.0) | 2165<br>0158-12-32(9.4) | 2180<br>0158-12(19.5) | 2185<br>0158-12-1(14.1) | |
|---|---|---|---|---|---|
| Stream site: | Cayuga Creek near Lancaster | Little Tonawanda at Linden | Tonawanda Creek at Rapids | Ellicott Creek at Williamsville | Lake Erie at Buffalo 1/ |
| Date of collection: | 5-8-63 | 5-8-63 | 5-8-63 | 5-8-63 | 8-22-61 |
| Stream discharge: | 28 cfs | 9.9 cfs | 165 cfs | 24 cfs | -- |
| Silica ($SiO_2$) | 0.1 | 3.1 | 1.5 | 1.0 | 2.0 |
| Iron (Fe) | .03 | .14 | .15 | .14 | .01 |
| Manganese (Mn) | .01 | .00 | .01 | .02 | .00 |
| Calcium (Ca) | 48 | 52 | 102 | 86 | 38 |
| Magnesium (Mg) | 13 | 10 | 16 | 14 | 8.6 |
| Sodium (Na) | 6.2 | 4.2 | 12 | 22 | 9.5 |
| Potassium (K) | 2.0 | 1.3 | 1.7 | 2.8 | 1.4 |
| Bicarbonate ($HCO_3$) | 149 | 172 | 219 | 196 | 116 |
| Carbonate ($CO_3$) | 0 | 0 | 0 | 0 | 0 |
| Sulfate ($SO_4$) | 43 | 28 | 134 | 103 | 23 |
| Chloride (Cl) | 14 | 6.8 | 31 | 42 | 23 |
| Fluoride (F) | .1 | .1 | .2 | .3 | .1 |
| Nitrate ($NO_3$) | 1.4 | 1.2 | 1.8 | 1.0 | .2 |
| Dissolved solids | 205 | 196 | 437 | 384 | 177 |
| Hardness as $CaCO_3$<br>Ca,Mg | 174 | 171 | 321 | 272 | 131 |
| Noncarbonate | 52 | 30 | 141 | 112 | 36 |
| Specific conductance (micromhos at 25°C) | 370 | 348 | 675 | 626 | 306 |
| pH | 8.1 | 8.1 | 7.4 | 7.7 | 8.0 |
| Color | 3 | 4 | 7 | 8 | 1 |
| Turbidity | .0 | .0 | .4 | .6 | .0 |
| Temperature (°F) | 59 | 62 | 62 | 62 | 75 |

1/ From Durfor and Becker, 1964a, p. 250.

Table 3.--Chemical characteristics of water during high, moderate, and low flows of four streams, representing various geologic and topographic environments; and of water in the Niagara River at Niagara Falls

| Stream site; Stream site number N.Y.State; USGS | Drainage area (sq mi) | Period of streamflow record | Average discharge (cfs) | Physical setting of basin | Major type of rocks underlying river basin | Sample collection: Date | Sample collection: Discharge (cfs) | Iron (Fe) (parts per million) | Sulfate ($SO_4$) (parts per million) | Chloride (Cl) (parts per million) | Dissolved solids (parts per million) | Hardness as $CaCO_3$ (Ca,Mg) (parts per million) | pH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cayuga Creek near Lancaster E1-6(11.0); 2150 | 93.3 | 1938-64 | 123 | Upland and lowland | Shale | Apr.16,1964 | 66 | 0.07 | 39 | 11 | 189 | 143 | 8.0 |
| | | | | | | May 8,1963 | 28 | .03 | 43 | 14 | 205 | 174 | 8.1 |
| | | | | | | July 5,1963 | 6.00 | .07 | 52 | 13 | 227 | 168 | 7.6 |
| Little Tonawanda Creek at Linden 0158-12-32(9.4);2165 | 22.0 | 1912-64 | 27.2 | Upland | Shale | Mar. 5,1964 | 1/ 709 | -- | 19 | -- | 100 | -- | -- |
| | | | | | | May 8,1963 | 9.9 | .14 | 28 | 6.8 | 196 | 171 | 8.1 |
| | | | | | | July 2,1963 | 1.84 | .11 | 33 | 6.4 | 234 | 201 | 7.9 |
| Tonawanda Creek at Rapids 0158-12(19.5);2180 | 358 | 1955-64 | 366 | Lowland and upland | Camillus Shale; limestone;other shale | Mar.19,1963 | 4,600 | -- | 35 | 16 | 176 | 114 | 7.8 |
| | | | | | | May 8,1963 | 165 | .15 | 134 | 31 | 437 | 321 | 7.4 |
| | | | | | | July 2,1963 | 48.0 | .09 | 240 | 48 | 650 | 455 | 7.4 |
| Ellicott Creek at Williamsville 0158-12-1(14.1);2185 | 76.3 | 1955-64 | 86.1 | Lowland | Limestone (underlain by Camillus Shale); | Mar.19,1963 | 1,240 | -- | 33 | 13 | 150 | 92 | 7.4 |
| | | | | | | May 8,1963 | 24 | .14 | 103 | 42 | 384 | 272 | 7.7 |
| | | | | | | July 2,1963 | .88 | .03 | 353 | 57 | 717 | 486 | 7.9 |
| Niagara River at Niagara Falls 0158(19.6);2160 | 2/ 260,400 | 2/ 1860-1964 | 2/ 203,000 | | | Jan. 6-10, 12,14,18,20,1959 3/ | 153,000 1/ | .03 | 22 | 23 | 197 | 132 | 7.6 |
| | | | | | | Oct.1958-Sept.1959 | | | | | | | |
| | | | | | | Maximum concentrations | | .08 | 27 | 25 | 203 | 144 | 7.8 |
| | | | | | | Minimum concentrations | | .01 | 21 | 20 | 179 | 124 | 7.3 |

1/ Daily mean discharge.
2/ Drainage area, period of record, and average discharge shown above are for the gaged site at Buffalo, but these data for practical purposes are equally applicable to the sampling site at Niagara Falls.
3/ Composite sample.

Table 4.--Comparison of chemical characteristics of water in the larger streams during times of low and very high flow

| STREAM<br>Upstream and downstream sampling iste; site number, N.Y. State system, U.S.G.S. system where used. | Drainage area above site (square miles) | Very high flow March 18,19, or 20, 1963 or March 5 or 9, 1964 Sulfate ($SO_4$) | Chloride (Cl) | Hardness as $CaCO_3$ | Low flow July 2 or 5, 1963 Sulfate ($SO_4$) | Chloride (Cl) | Hardness as $CaCO_3$ |
|---|---|---|---|---|---|---|---|
| | | (parts per million) | | | (parts per million) | | |
| CATTARAUGUS CREEK (total drainage area, 554 square miles) | | | | | | | |
| UP: Near Arcade; E23(54.7); 2134.1 | 78.4 | 18 | 7.0 | 69 | 18 | 9.7 | 138 |
| DOWN: At Gowanda; E23(17.4); 2135 | 432 | 23 | 5.2 | 90 | 41 | 37 | 177 |
| EIGHTEENMILE CREEK (total drainage area, 120 square miles) | | | | | | | |
| UP: At North Boston; E23(15.3); 2142 | 37.2 | 24 | 7.5 | 64 | 43 | 19 | 168 |
| DOWN: At Highland-on-the-Lake; E13(0.5); 2142.4 | 119 | -- | -- | -- | 70 | 80 | 215 |
| CAYUGA CREEK (total drainage area, 126 square miles) | | | | | | | |
| UP: At Cowlesville; E1-6(23.3) | 43.1 | -- | -- | -- | 48 | 24 | 190 |
| DOWN: Near Lancaster; E1-6(11.0); 2150 | 94.9 | -- | -- | -- | 52 | 13 | 168 |
| BUFFALO CREEK (total drainage area, 149 square miles) | | | | | | | |
| UP: Near Wales Hollow; E1(31.8); 2144 | 80.1 | 23 | 5.8 | 78 | 41 | 10 | 190 |
| DOWN: At Gardenville; E1(10.4); 2145 | 144 | 34 | -- | --- | 55 | 12 | 163 |
| CAZENOVIA CREEK (total drainage area, 138 square miles) | | | | | | | |
| UP: East Branch Cazenovia Creek at South Wales; E1-4-14(8.1); 2153.5 | 38.0 | 22 | 11 | 56 | 38 | 12 | 146 |
| DOWN: Cazenovia Creek at Ebenezer; E1-4(4.1); 2155 | 136 | 26 | 12 | 68 | 69 | 48 | 190 |
| TONAWANDA CREEK (total drainage area, 631 square miles) | | | | | | | |
| UP: Near Johnsonburg; 0158-12(100.6); 2164 | 23.6 | 18 | 3.4 | 85 | 27 | 5.8 | 171 |
| DOWN: At Rapids; 0158-12(19.5); 2180 | 352 | 35 | 16 | 114 | 240 | 48 | 455 |
| ELLICOTT CREEK (total drainage area, 110 square miles) | | | | | | | |
| UP: Near Crittenden; 0158-12-1(39.9) | 21.0 | -- | -- | -- | 37 | 34 | 165 |
| DOWN: At Williamsville; 0158-12-1(14.1) 2185 | 72.4 | 33 | 13 | 92 | 353 | 57 | 486 |

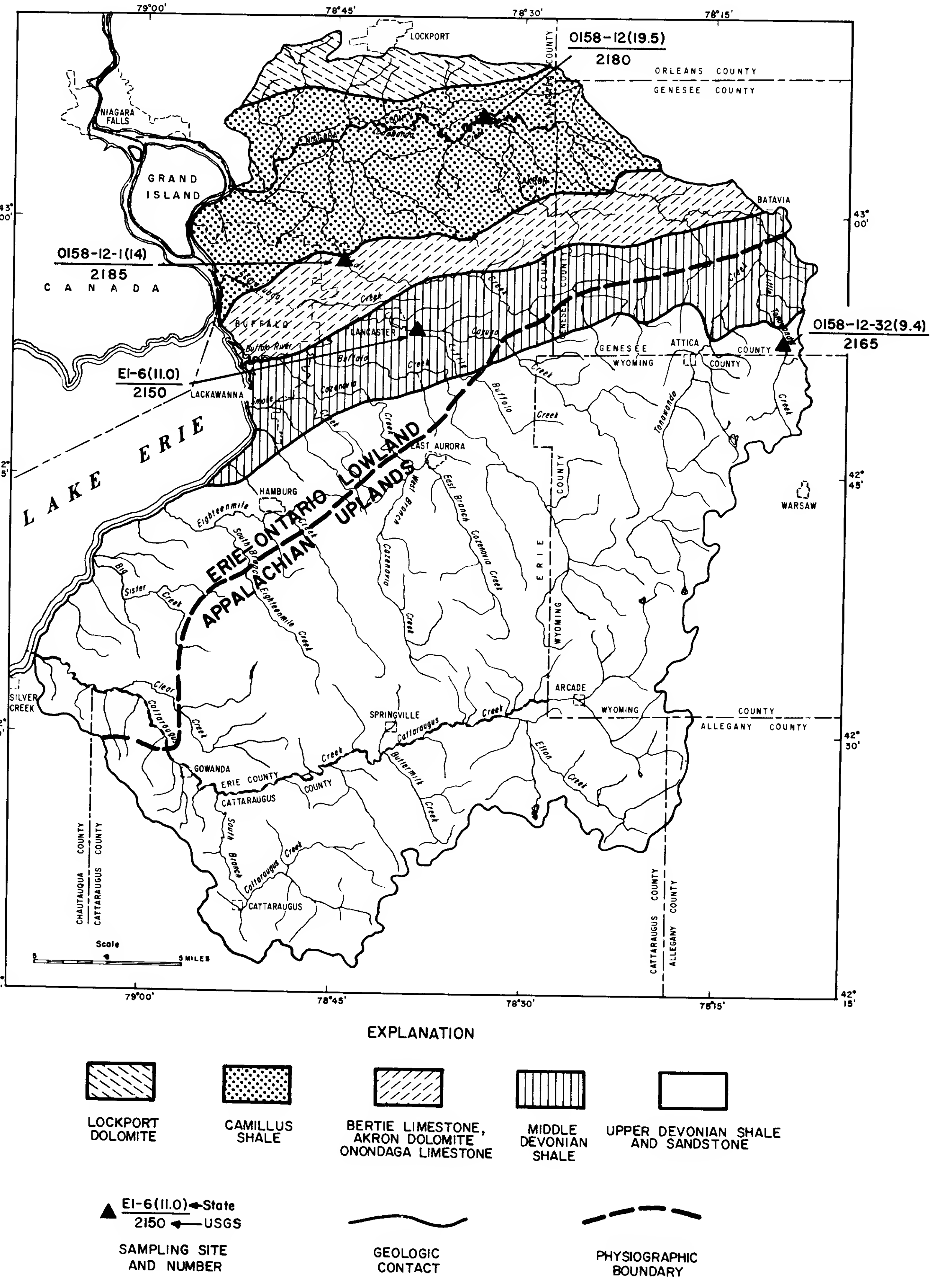



Figure 1.--Generalized bedrock geology and physiographic divisions.

# CHEMICAL QUALITY AND THE WATER CYCLE

As water moves through different environments in the hydrologic cycle its chemical quality changes, as is indicated in figure 2. Precipitation dissolves materials present in the atmosphere and carries them to the land surface. Generally the dissolved solids in precipitation are very low, but precipitation in some areas gains a high concentration of dissolved solids from impurities in the atmosphere. After precipitation reaches the land surface, it is further modified chemically before reaching the streams. Most water reaches streams or lakes by flowing rapidly over the land surface. As it flows, the water dissolves materials from the soil and dust particles lying on the surface. Overland flow is nevertheless low in dissolved solids compared to average stream quality. A significant quantity of water also reaches the streams by infiltrating to the saturated zone and moving laterally in the subsurface as ground water. This water dissolves materials from the soil and rocks above the saturated zone (the zone of aeration) and from the materials in the saturated zone. The concentrations of dissolved solids in ground water within this area are high compared to average stream quality.

Ordinarily, because of the high frequency of precipitation in the Erie-Niagara basin, streams carry water which is a mixture of overland flow and ground water except during long dry periods. The relatively low dissolved-solids content of overland flow is the predominant controlling factor of the chemical quality of water in streams during floods and large flows. During periods of low streamflow, the quality of streamflow is largely determined by the quality of the ground water entering the streams.

Table 5 summarizes the major part of the analytical data obtained in the Erie-Niagara basin, including precipitation and overland flow. Also included are data on high streamflow, which is predominantly from overland flow, and data on low streamflow, which is almost entirely the contribution of ground water. The chemical characteristics and variations of these various facets of the water cycle will be discussed in the sections that follow.

## PRECIPITATION

As water falls upon the earth as rain or snow it dissolves some of the impurities -- gases and particles -- in the atmosphere. The principal sources of the impurities are the fully or partly burned residues and gases discharged into the atmosphere by man from his home-heating systems, factories, automobiles, incinerators, and dumps. These impurities may return to the land near where they were earlier discharged, or may be windborne for many miles depending upon the kind, form, and concentration of the impurity, upon the wind currents, and upon the associated local and regional patterns of precipitation.

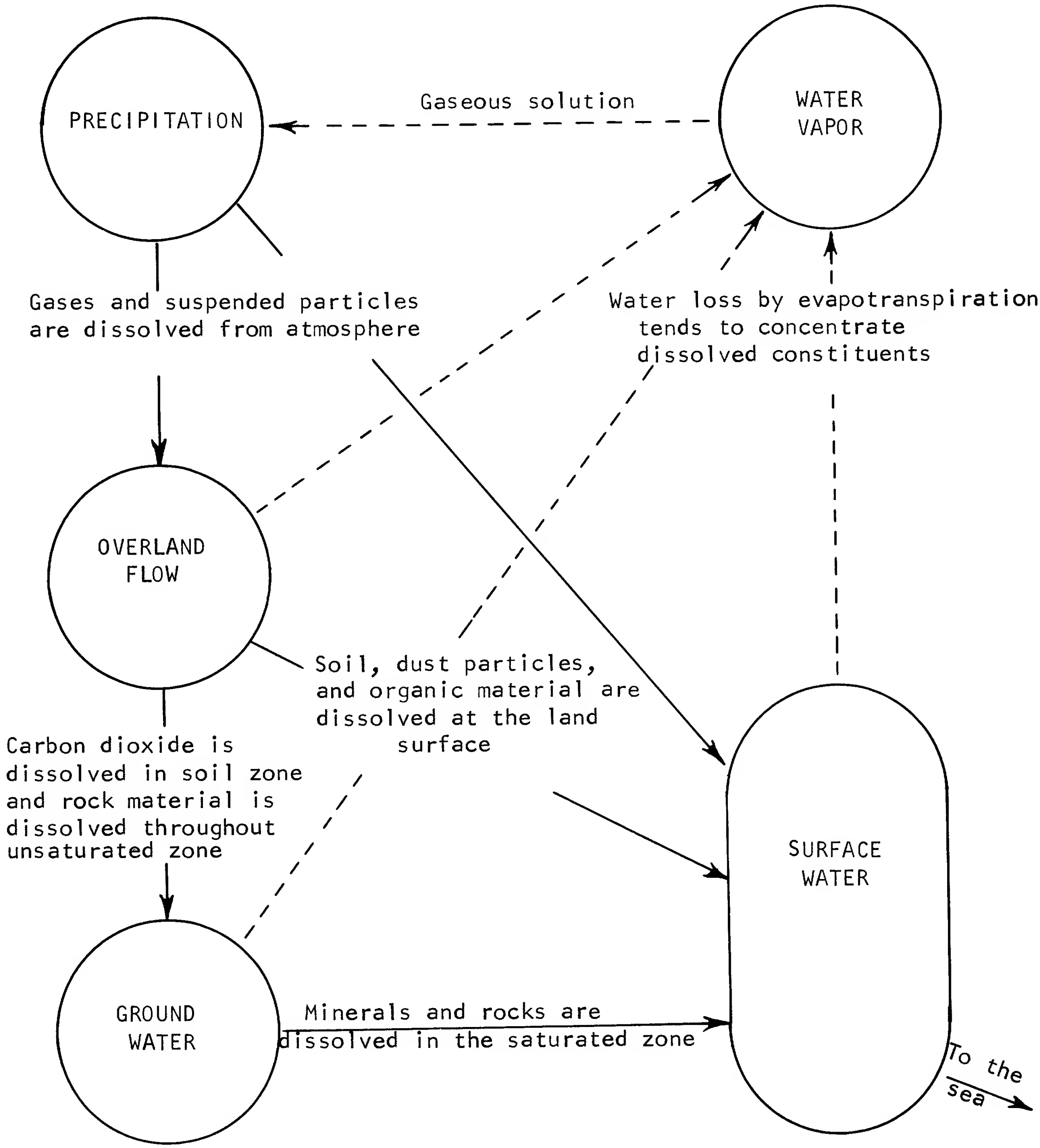



Figure 2.--Sources of dissolved constituents in water moving through the hydrologic cycle.

## Table 5.--Representative ranges in selected chemical properties of precipitation and streamflow during parts of 1963 and 1964

Note: This table has been compiled from data in the tables in the back of this report by determining the "middle-80-percent" values--that is, the range of values remaining after the highest 10 percent and lowest 10 percent of data have been eliminated.

| | Number of samples collected 1/ | Calcium (Ca) (parts per million) | Sulfate ($SO_4$) (parts per million) | Chloride (Cl) (parts per million) | Dissolved solids (parts per million) | Specific conductance (micromhos at 25°C) | Hardness as $CaCO_3$ (Ca, Mg) | pH |
|---|---|---|---|---|---|---|---|---|
| Precipitation (1963) | | | | | | | | |
| North of latitude 42°40' | 59 (4 sites) | 3-8 | 7-25 | 0.0-1.1 | -- | 37-110 | -- | 6.0-6.8 |
| At and south of latitude 42°40' | 46 (3 sites) | 3-8 | 5-20 | .0-.1 | -- | 24-109 | -- | 6.0-6.6 |
| Snow (Feb. 17-18, 1964; Jan. 14, 1965; Feb. 2, 1965) | | | | | | | | |
| North of latitude 42°40' | 47 (35 sites) | 1-10 | 1-167 2/ | 1-30 | -- | 26-439 | -- | 3.3-5.6 |
| At and south of latitude 42°40' | 24 (24 sites) | 1-6 | 2-9 | 1-10 | -- | 25-87 | -- | 3.9-4.7 |
| Overland flow (Mar. 5, 9, 1964) | | | | | | | | |
| South of latitude 42°45' | 13 (13 sites) | -- | 8-16 | .6-1.5 | -- | 38-264 | 14-19 | -- |
| High streamflow (Mar. 4, 5, 9, 1964) | | | | | | | | |
| Tonawanda Creek basin west of Batavia | 35 (32 sites) | -- | 19-48 | 5-18 | 123-260 | 118-361 | 40-112 | -- |
| All other parts of Lake Erie-Niagara area | 106 (101 sites) | -- | 11-29 | 2-8 | 68-187 | 84-187 | 29-79 | -- |
| Low streamflow (July 2, 4, 5, 1963) | | | | | | | | |
| Tonawanda Creek basin west of Batavia | 28 (27 sites) | 80-165 | 37-1,190 | 22-107 | 410-717 | 399-2,070 | 163-1,410 | 7.3-7.9 |
| All other parts of Lake Erie-Niagara area | 136 (135 sites) | 44-61 | 21-80 | 6-53 | 170-296 | 286-599 | 126-244 | 7.0-8.3 |

1/ Number of specific conductance samples; fewer samples were taken for other characteristics and constituents.

2/ "Middle-80-percent" range for snow of Feb. 17-18, 1964, considered separately, was 5-174 ppm $SO_4$.

However, the likelihood of significant quantities of atmospheric impurities being available for solution by precipitation, increases considerably near highly industrialized areas. Buffalo, particularly because of its amount of heavy industries, is the source of considerable smoke and fumes, which are carried eastward by the prevailing winds. Atmospheric impurities from the Great Lakes industrial region to the west probably are also carried into the area.

Although the concentrations of most dissolved constituents in precipitation are usually small, generally totaling less than 50 ppm in inland regions (Junge and Werby, 1958), the concentrations of some constituents are large enough to be measurable by routine methods of chemical analysis. Also, the concentrations occasionally are found to be significantly higher than 50 ppm, as was the situation for a large number of samples of the snowfall of February 16, 1964, collected in the northern part of the Erie-Niagara basin.

Precipitation from moderate or large storms that occurred between March and September 1963 was sampled at seven U.S. Weather Bureau stations, and snow from the storm of February 16, 1964, was sampled at 59 sites. The results are summarized in table 5 and in figure 3, which include locations of all sampling sites. Additional snow samples were collected at six of the same sites on January 14 and February 2, 1965. Chemical data on all the samples from the Weather Bureau Stations are given in table 14, and the analyses of snow are in table 15.

Table 5 and figure 3 show that the quality of most of the samples collected at the Weather Bureau Stations varied within relatively narrow ranges during 1963, such as 3-8 ppm of calcium; 5-25 ppm of sulfate; 0-1.1 ppm of chloride; 20-70 ppm of dissolved solids (estimated from specific conductance values in the range from 24 to 110 micromhos). However, some unusually high values were recorded in a few of the analyses of rainfall, such as 26 ppm of calcium, 99 ppm of sulfate, and 6.7 ppm of chloride (each at a different site).

Precipitation was higher in dissolved solids at the Weather Bureau Stations downwind from Buffalo than at those stations on a line south of Buffalo. An exception is the station at Gowanda, which is near a local source of air pollution. The median dissolved-solids concentration (estimated from specific conductance) at Linden, due east of Buffalo, was about two times the median concentrations at Arcade, in the southwest corner of Wyoming County, and at Colden, southeast of Hamburg.

Figure 3 shows the areal variations in calcium, sulfate, chloride, and specific conductance from the sampling of the snowstorm of February 16, 1964. The winds during this storm were from the southwest, and there is a significant areal variation in the snow data shown in figure 3. High values of sulfate concentration and specific conductance are more prevalent in samples from the northern half of the area. Apparently, this particular snowstorm dissolved a larger than usual amount of airborne impurities in the vicinity of buffalo, and carried them to the ground in much of the northern half of the study area. Snow samples from six of the

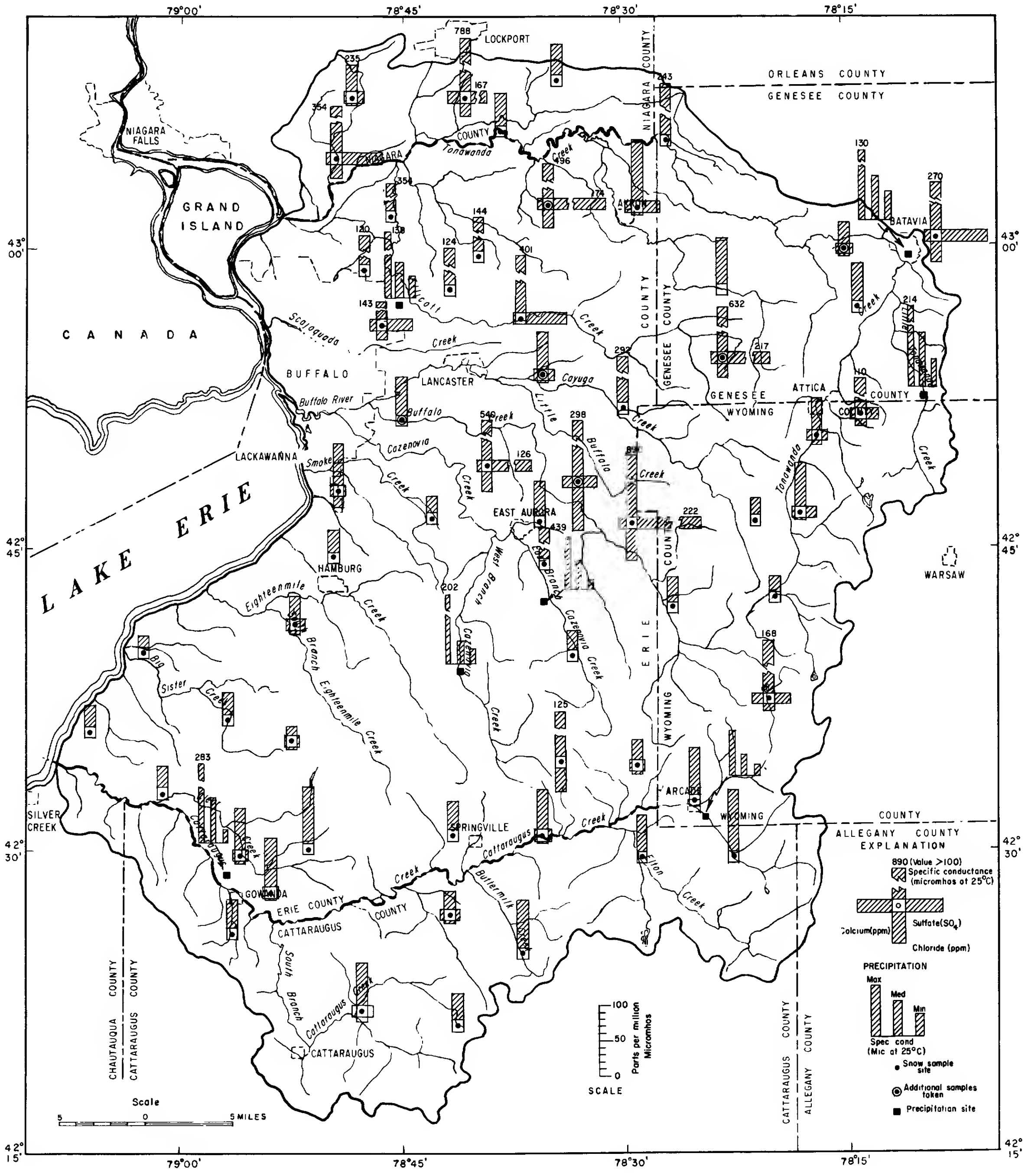


Figure 3.--Chemical quality of snow from the storm of February 16, 1964, and the maximum, minimum, and median observed specific conductance of samples collected at precipitation sites, March to September 1963.

same sites early in 1965, showed lower concentrations of sulfate, chloride, and dissolved solids that were more nearly comparable to the chemical quality of rainfall. Fairly typical chemical concentrations north and south of north latitude 42°40'00", for the storm of February 16, 1964, are about as follows:

| | North (ppm) | South (ppm) |
|---|---|---|
| Calcium | 6 | 2 |
| Sulfate | 60 | 4 |
| Chloride | 16 | 4 |
| Dissolved solids | 140 | 30 |

It should be noted that snow samples, both in 1964 and 1965, had consistently higher concentrations of chloride than the rainfall samples of 1963.

Regionwide, the streams of the Erie-Niagara basin receive precipitation containing, on an average, the following concentrations of the constituents listed:

| | (Parts per million) |
|---|---|
| Calcium | 5 |
| Sulfate | 10 |
| Chloride | 0.1 |
| Dissolved solids | 35 |

Somewhat higher concentrations commonly occur near or downwind from industrial area. Also, chloride concentrations of 5-10 ppm are common in snow.

## OVERLAND FLOW

The part of precipitation that neither seeps into the ground nor evaporates moves over the land surface until it reaches a stream channel. The overland flow contains not only the chemical constituents dissolved by the precipitation from the atmosphere, but also constituents dissolved from the soil and exposed rock materials, evaporation residues, and atmospheric fallout that has accumulated since the preceding overland flow. Despite the variety of sources of impurities, only a small amount of dissolved material is normally added to the overland flow.

Most of the samples of overland flow which were collected and analyzed for the Erie-Niagara study were obtained in the Cattaraugus Creek basin, on March 5, 1964, concurrently with sampling of high streamflow. The cause of the runoff was a light to heavy rain and melting of a snowpack. The locations and analyses of all 17 samples of overland flow are given in table 16, and analyses of 13 of the samples are summarized on one line of table 5.

For the Cattaraugus Creek basin, the limited data show little increase in concentration of sulfate, chloride, and total dissolved solids, from that found in precipitation. The nine samples collected on March 5, 1964, had the following ranges of values:

| | ppm | Samples |
|---|---|---|
| Sulfate | 7.8 - 16 | 8 |
| Chloride | .5 - 2.1 | 7 |
| Hardness as $CaCO_3$ | 8 - 21 | 7 |
| Dissolved solids | 17 - 120 1/ | 9 |

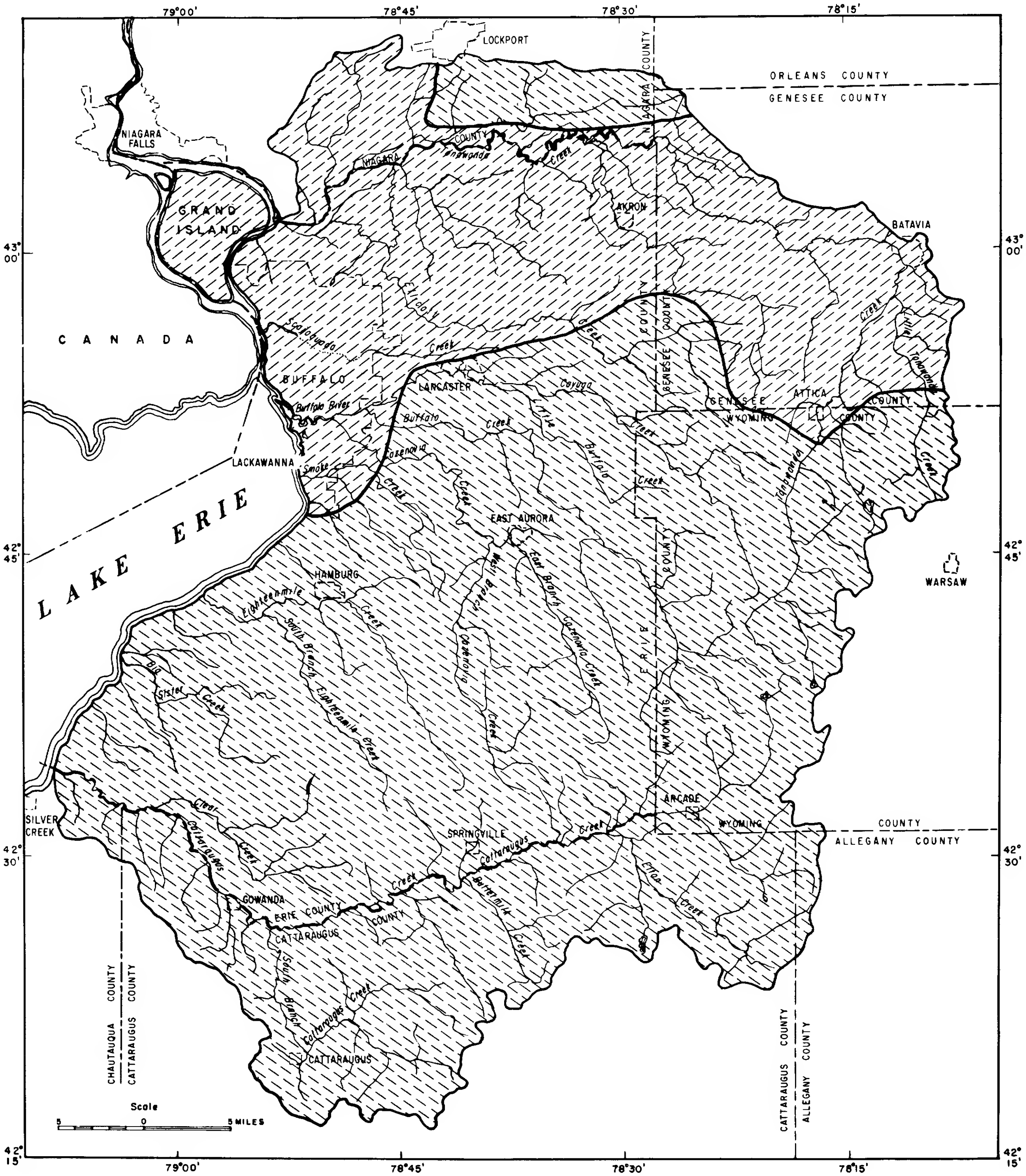
1/ Calculated by multiplying the specific conductance values by 0.67.

The chemical quality of the water in small streams during periods of high flow is representative to a large extent of the quality of the water in overland flow, because the water in the streams during those periods is derived largely, or entirely, from rain or melting snow. Therefore, the chemical analyses of very high streamflow (table 17) in small streams provide a more areawide picture of the chemical quality of overland flow. In most of the central and southern parts of the area the concentrations in parts per million were generally:

Sulfate, less than 20 ppm
Chloride, less than 10 ppm
Hardness (as calcite), less than 60 ppm (except in some parts of the Buffalo River basin)
Dissolved solids, less than 120 ppm

Higher concentrations at some sites in the southern and central parts of the area probably resulted from local pollution, such as an increase in chlorides from salt-treated roads. Because of both greater air pollution and higher rock solubilities in the northern part of the area, concentrations of sulfate and dissolved solids were noticeably higher in much of the Tonawanda Creek basin. Generally in most of the central and southern parts of the Erie-Niagara basin, the concentrations of sulfate were less than 20 ppm, chloride less than 10 ppm, hardness (as $CaCO_3$) less than 60 ppm (except in some parts of the Buffalo River basin), and dissolved solids less than 120 ppm. Higher concentrations at some sites in the southern and central parts of the area were probably the result of local pollution, including high chlorides from salt-treated streets and highways. Sulfate and dissolved-solids concentrations were noticeably higher in much of the Tonawanda Creek basin, a consequence of precipitation high in dissolved solids due to air pollution and also of the greater solubility of rocks in the northern part of the Erie-Niagara basin.

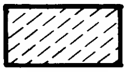
Figure 4 shows the general regional quality of overland flow in terms of specific-conductance determinations. The ranges in specific conductance shown in the figure correspond roughly to ranges of dissolved-solids concentrations of 16 - 100 ppm and 100 - 200 ppm, respectively. Note that the higher range applies to the Buffalo and to the lower Tonawanda Creek basins (northeast and east of Buffalo).




EXPLANATION

Specific conductance range, in micromhos at 25°C

25-150



151-300

Figure 4.--Specific conductance of overland flow.

From the information gathered about the first two prestream contributors of dissolved mineral matter, precipitation seems to contribute more dissolved minerals to the streams than overland flow. However, two possible exceptions exist: in the lower Tonawanda Creek basin, overland flow at times may dissolve unusually large amounts of atmospheric fallout that has accumulated on the land surface, and locally overland flow may contain considerable salt that was applied to roads during the winter.

A more detailed discussion of the chemical quality of the streams during periods of overland flow follows the next section on ground water.

## GROUND WATER

There are several ways for rain and melted snow to reach a stream and become streamflow, but the longest and slowest path is into and through the ground - the path followed by ground water. Thus, ground water, or more precisely its effluent or "runoff", is the predominant component of flow of perennial streams, large and small, most of the time. Therefore, ground water has the greatest single influence upon the chemical quality of water in streams. Overland flow is predominant in quantity only during and soon after either periods of substantial precipitation, or periods of major thaw in winter or spring, and it is only during these periods that the chemical quality of precipitation or overland flow is the principal influence upon the chemical quality of water in most streams.

Ground water and its chemical quality are discussed in detail in another of this series of reports on water in the Erie-Niagara Basin (LaSala, 1968). The discussion below is therefore brief. The effects of ground water upon the quality of water in streams are strongest during times of low streamflow (base flow), when there no longer remains in the streams any significant amount of water derived directly from precipitation or overland flow. A later section of this report describes the quality of water in streams at low flow.

Figure 1 shows some of the principal divisions of bedrock in the Erie-Niagara basin. The rocks are layered and dip to the south at about 40 feet per mile, and thus progressively younger rocks are exposed southward. For example, the northernmost unit is the Lockport Dolomite, which is overlain by the Camillus Shale. The Camillus, in turn, is successively overlain by the Bertie Limestone and Akron Dolomite and the Onondaga Limestone. The rocks are covered throughout most of the area by glacial deposits of till, clay, silt, sand, and gravel. These glacial deposits are thin, in many places less than 50 feet or even 10 feet thick, especially on hills and hillsides. In some valleys of the Appalachian uplands the deposits are much thicker and at places are as much as 600 feet thick.

As is shown in table 6 (from LaSala, Harding, and Archer, 1964), the quality of ground water in the Erie-Niagara basin varies considerably from one water-bearing unit to another, and even varies within the same unit. The latter variations in part result from the character of the

Table 6.--Summary of chemical analyses of ground water (Adapted from LaSala, Harding, and Archer, 1964)

| Water-bearing units | Number of samples | Sulfate ($SO_4$) | | | Chloride (Cl) | | | Hardness as $CaCO_3$ | | | Specific conductance | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Maximum (ppm) | Minimum (ppm) | Median (ppm) | Maximum (ppm) | Minimum (ppm) | Median (ppm) | Maximum (ppm) | Minimum (ppm) | Median (ppm) | Maximum (ppm) | Minimum (ppm) | Median (ppm) |
| Camillus Shale | 12 | 1,950 | 134 | 1,100 | 2,520 | 7.0 | 214 | 2,780 | 319 | 1,410 | 9,010 | 597 | 2,370 |
| Glacial deposits overlying Camillus Shale | 7 | 1,250 | 244 | 623 | 650 | 6.8 | 84 | 1,690 | 413 | 851 | 4,270 | 960 | 1,650 |
| Lockport Dolomite and Onondaga Limestone | 8 | 469 | 31 | 104 | 334 | 2.2 | 29 | 838 | 200 | 333 | 1,750 | 504 | 936 |
| Middle and Upper Devonian shale and sandstone | 37 | 164 | .0 | 19 | 120 | 1.0 | 17 | 621 | 52 | 236 | 1,290 | 187 | 523 |
| Glacial deposits overlying Middle and Upper Devonian shale and sandstone | 64 | 179 | .0 | 18 | 123 | .8 | 10 | 412 | 22 | 158 | 1,120 | 66 | 392 |

ground-water flow system, described by LaSala (1968). The minimum dissolved-solids content of ground water in the area is about 40 ppm, and the maximum is about 7,000 ppm. Concentrations of dissolved solids are generally between 55 and 80 percent of the values of specific conductance shown in table 6.

The most highly mineralized ground water occurs in the Camillus Shale (fig. 1), because this shale contains relatively soluble gypsum (calcium sulfate). Further downdip (southward from its outcrop belt) the Camillus Shale is thickly covered by overlying shale formations and contains beds of salt (sodium chloride). Ground water that has circulated down to the salt beds discharges to the downstream reach of Tonawanda Creek and locally increases the dissolved-solids content of water at shallow depth in the Camillus. Hardness, the soap-consuming and lime-depositing tendency of some waters, is caused by compounds of calcium and magnesium, which are very abundant in ground water from the Camillus Shale.

The Lockport Dolomite, Bertie Limestone, Akron Dolomite, and Onondaga Limestone also yield water that is high in dissolved solids. Their ground waters are hard, because the calcium and magnesium carbonate minerals composing the rock are fairly soluble. Most ground water in the Lockport has a high concentration of sulfate, which is dissolved from gypsum nodules that occur in the formation. Ground water high in sulfate occurs also in the western part of the outcrop belt of the Bertie, Akron, and Onondaga, where water is discharging upward from the underlying Camillus Shale.

Most of the central and southern parts of the Erie-Niagara basin are underlain by shale and some sandstone of Middle or Late Devonian age, which contain disseminated calcium carbonate and some thin limestone beds. Ground water that percolates downward through the rocks dissolves carbonate minerals, which make the water hard. Nevertheless, the ground water is considerably lower in dissolved solids than that in the northern part of the area. In some discharge areas, however, the shale and sandstone contain more highly mineralized water that may have circulated as deep as the Camillus Shale. Because of such circulation, the shale and sandstone may contain water exceptionally hard, and high in either sulfate or chloride, especially in areas along Lake Erie, near the outcrop of the Onondaga Limestone, and in a few valleys of the upland region.

Ground water from glacial deposits overlying the rock units shown in figure 1 has somewhat similar chemical characteristics to the underlying bedrock. Ground water that has circulated to only a shallow depth in the glacial deposits is usually less mineralized than water from the underlying bedrock, because the glacial deposits have been leached to a greater extent of some of the more soluble materials. However, ground water that has moved into the glacial deposits from the underlying bedrock generally is high in dissolved solids.

The relation of the principal streams to the underlying bedrock units is shown in figure 1. It is clearly evident from this figure and table 6 that the most highly mineralized ground water occurs in the northern part

of the region, and that the major streams affected by this mineralized water are Tonawanda Creek west of Batavia and Ellicott Creek. This situation will be emphasized again in a later section on the quality of water in streams at low flow.

# CHEMICAL QUALITY OF STREAMS DURING PERIODS OF OVERLAND FLOW

The most rapid natural changes in the chemical quality of streams occur during the most rapid natural changes in rates of streamflow, which in turn are caused by heavy or moderate precipitation, by a significant thaw (melting substantial quantities of snow and ice), or by a combination of these effects. In most years a coincident rainfall and thaw occurs at least once in late winter or early spring, and the resulting streamflow is the largest, or among the largest, of each year.

It is at such times of high streamflow that the water in the stream is of the best quality, at least in terms of low mineralization, because most of the water consists of overland runoff, and there is only a small proportion of the more mineralized ground water in the stream. However, two disadvantages are associated with this situation: (1) the water is more likely to be turbid and contain higher concentrations of sediment than at other times; and (2) high flows usually occur during only a few weeks of the year, so that storage reservoirs would be required if the water were to be saved for later use.

This high-flow, low-mineral-content water represents one extreme of the range of water quality, and in order to define better this aspect of the water quality of streams, more than 150 samples of high-flow water were collected in the Erie-Niagara basin during March 1964. Analyses of these samples are summarized in table 5. Results of each analysis are given in table 17, along with some analyses of high-flow samples collected in March 1963. The location of each site is shown in plate 1, including the names of streams and places mentioned in the following paragraphs.

The climatic conditions and chemical results of sampling of high-flow streams on March 4, 5, and 9, 1964, are described briefly below. The local climatic data are listed in table 7. The analyses of overland flow samples collected during this same period have already been discussed.

Only a trace of precipitation at a few stations occurred in the area between the light snows of February 26 and 27 and the rain of the evening of March 4 and morning of March 5. During the period February 28 to March 5, a gradual warming trend occurred with air temperatures reaching into the forties to low sixties during the day and dropping to near freezing or below during the night. This caused daily melting and freezing of snow on the ground. At Buffalo.on March 1, there was 4 inches of snow on the ground with a water content of 1.2 inches; by March 3, the snow had all melted. At Colden the 19 inches of snow on the ground on March 1 had melted and compacted to 12 inches by March 4, and to a trace by March 9. At Arcade there was 7 inches on March 1, 6 inches on March 4, and 3 inches on March 9.

Stream stages showed a gradually rising trend with diurnal fluctuations resulting from daytime melting of the snow during the period prior to March 4. The rain of March 4 and 5 and the melting of snow caused sharp rises in the streams. The March 1 to 4 thaws produced runoff that initial diluting of ground water in the streams and some flushing of

Table 7.--Precipitation and air temperature preceding and during sampling of streams, at very high flows, February 26 to March 9, 1964 (U.S. Weather Bureau, 1964a and 1964b)

Daily precipitation, in inches (T=trace)

| Date 1964 | Arcade | Batavia | Buffalo Airport | Colden (1 mile north) | Gowanda | Linden | South Wales | Wales |
|---|---|---|---|---|---|---|---|---|
| Feb. 26 | 0.15 | 0.06 | 0.18 | 0.22 | 0.16 | 0.13 | -- | -- |
| 27 | .02 | .02 | .02 | .01 | .06 | .04 | -- | -- |
| 28 | 0 | 0 | 0 | 0 | 0 | 0 | -- | -- |
| 29 | 0 | 0 | T | 0 | 0 | 0 | -- | -- |
| Mar. 1 | 0 | 0 | T | T | 0 | 0 | 0 | 0 |
| 2 | 0 | 0 | 0 | 0 | T | 0 | 0 | 0 |
| 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 4 | 0 | 0 | .30 | .04 | 0 | .05 | 0 | .47 |
| 5 | .69 | .30 | .13 | .80 | .53 | 0 | .36 | .24 |
| 6 | .76 | 0 | .02 | T | T | 0 | 0 | 0 |
| 7 | 0 | 0 | 0 | 0 | 0 | .20 | 0 | 0 |
| 8 | .10 | .13 | .08 | .13 | 0 | 0 | 0 | .21 |
| 9 | .33 | .22 | .52 | .40 | .27 | .30 | T | .26 |

Daily air temperature, in °F

| Date 1964 | Arcade Max. | Arcade Min. | Batavia Max. | Batavia Min. | Buffalo Airport Max. | Buffalo Airport Min. | Colden (1 mile north) Max. | Colden (1 mile north) Min. | Gowanda Max. | Gowanda Min. | South Wales Max. | South Wales Min. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Feb. 26 | 36 | 19 | 41 | 18 | 35 | 22 | 38 | 22 | 42 | 25 | -- | -- |
| 27 | 25 | 1 | 25 | 8 | 23 | 5 | 25 | -4 | 29 | 9 | -- | -- |
| 28 | 34 | -11 | 32 | -3 | 29 | 4 | 31 | -5 | 27 | 2 | -- | -- |
| 29 | 38 | 10 | 39 | 15 | 39 | 14 | 39 | 7 | 34 | 13 | -- | -- |
| Mar. 1 | -- | -- | 40 | 30 | 41 | 31 | 38 | 28 | 40 | 28 | 40 | 27 |
| 2 | 52 | 30 | 50 | 32 | 46 | 32 | 50 | 26 | 44 | 33 | 41 | 27 |
| 3 | 56 | 26 | 57 | 29 | 56 | 36 | 60 | 28 | 54 | 34 | 52 | 26 |
| 4 | 49 | 29 | 54 | 37 | 53 | 38 | 50 | 30 | 62 | 35 | 59 | 29 |
| 5 | -- | -- | 59 | 30 | 58 | 29 | 55 | 30 | 60 | 45 | 54 | 30 |
| 6 | 40 | 23 | 40 | 25 | 40 | 27 | 41 | 25 | 55 | 27 | 55 | 22 |
| 7 | 54 | 32 | 54 | 31 | 51 | 30 | 50 | 27 | 53 | 30 | 47 | 26 |
| 8 | 39 | 24 | 42 | 28 | 39 | 29 | 38 | 26 | 54 | 29 | 54 | 26 |
| 9 | 55 | 30 | 57 | 30 | 48 | 29 | 55 | 31 | 58 | 33 | 50 | 24 |

Snowfall, in inches (T=trace)

| Date | Arcade | Buffalo Airport | Colden (1 mile north) |
|---|---|---|---|
| Feb. 26 | 2.0 | 2.5 | 3.3 |
| 27 | .3 | .3 | .5 |
| 28 | 0 | 0 | 0 |
| 29 | 0 | T | 0 |
| Mar. 1 | 0 | T | T |
| 2 | 0 | 0 | 0 |
| 3 | 0 | 0 | 0 |
| 4 | 0 | 0 | 0 |
| 5 | 0 | .4 | .1 |
| 6 | 0 | .2 | T |
| 7 | 0 | 0 | 0 |
| 8 | 0 | 1.0 | 1.5 |
| 9 | 0 | T | .1 |

Snow on ground, in inches (T=trace)

| Date | Arcade | Buffalo Airport | Colden (1 mile north) |
|---|---|---|---|
| Feb. 26 | 10 | 4 | 21 |
| 27 | 10 | 6 | 21 |
| 28 | 10 | 6 | 20 |
| 29 | 8 | 5 | 19 |
| Mar. 1 | 7 | 4 | 19 |
| 2 | 7 | 3 | 17 |
| 3 | 6 | T | 14 |
| 4 | 6 | T | 12 |
| 5 | 5 | T | 8 |
| 6 | 5 | T | 6 |
| 7 | 4 | 0 | 4 |
| 8 | 4 | 0 | 2 |
| 9 | 3 | 0 | T |

surface areas. The runoff from the March 4-5 rain caused further dilution, and in most headwater areas the water-quality effect of ground water on the streams was insignificant at the time of sampling. In the downstream areas, however the effects of ground-water discharge on quality were still apparent, though subdued.

Table 8 is a summary by stream, basin, or section of the project area of some of the chemical characteristics of the water from streams during the period of high flow of March 4-9, 1964. Because the runoff of March 4-5 is likely to be equaled or exceeded annually, this chemical-quality condition might be expected at least annually. Some of the more significant interpretations, variations, or limitations of the analyses and additional available data on the chemical quality of high streamflow are discussed in the following section.

The chemical quality of surface water during the period of March 4-5 closely approached that of overland flow in the following streams: (1) tributaries of Cattaraugus Creek and Cattaraugus Creek itself upstream from Hosmer Brook, (2) small streams south of Eighteenmile Creek and draining directly into Lake Erie, (3) the headwaters and upstream tributaries of Cazenovia, Buffalo, Cayuga, Tonawanda, and Eighteenmile Creeks. These streams have in common either steep gradients or a low channel-storage capacity, or both. The larger streams with flatter gradients and greater channel storage had much higher specific conductances on March 4 and 5. Water of high specific conductance in the channels of these larger streams prior to the runoff apparently was not flushed rapidly out of the channels. Though the water with high specific conductance was considerably diluted, it strongly affected the quality of water in Cattaraugus Creek downstream from Arcade, in the lower reaches of Buffalo, Cazenovia, and in Cayuga Creeks, and in Tonawanda Creek downstream from Batavia.

The specific conductances of streams tributary to the Barge Canal and Tonawanda Creek just west of the Barge Canal generally were the highest of all in the Erie-Niagara basin. In this part of the study area there is a great deal of water stored in channels and swales. Rather than flushing such storage downstream, overland runoff may only dilute the accumulated concentration of dissolved solids.

The lower reaches of streams draining directly into Lake Erie were found to have relatively high specific conductances on March 9, 1964 (table 8, line 4). The quality of water in these streams was affected by a relatively high rate of ground-water discharge, because ground-water storage increased between March 4 and March 9. Ground-water discharge increases with ground-water storage, and greater amounts of overland flow are required to dilute the effects of ground water on stream quality during the seasonal period of ground-water recharge.

Table 8.--Some chemical characteristics of water from streams during the high-flow period of March 4-9, 1964

| Stream basin, or section of project area | Approximate concentration or range: Specific conductance (micromhos) | Sulfate (ppm) | Chloride (ppm) | Hardness (ppm) | Remarks |
|---|---|---|---|---|---|
| Cattaraugus Creek, upstream from Hosmer Brook and most tributaries. | Generally 150, often 100 | 10 to 20 | 5 | 20 to 60 | |
| Cattaraugus Creek, downstream from Hosmer Brook and a few of the larger tributaries. | 200 to 260 | -- | -- | -- | Effects of ground water still significant in these streams. |
| Headwaters of small streams draining directly into Lake Erie, south of Eighteenmile Creek. | 85 to 120 | <25 | <10 | <60 | |
| Lower reaches of small streams draining directly into Lake Erie, south of Eighteenmile Creek. | 200 to 315 | -- | -- | -- | All samples collected Mar. 9. Ground water may have significant effect on the chemical quality at this time. |
| Headwaters of and most tributary streams of Eighteen-mile Creek and Buffalo River basin. | 78 to 194 generally <150 | <30 | <10 | <70 | |
| Lower Buffalo River basin main stem streams. | >200 | -- | -- | -- | |
| Tonawanda Creek basin south of Genesee-Wyoming County line. | <200 | <20 | <10 | <90 | |

Table 8.--Some chemical characteristics of water from streams during the high-flow period of March 4-9, 1964 (Continued)

| Stream basin, or section of project area | Approximate concentration or range | | | | Remarks |
| --- | --- | --- | --- | --- | --- |
| | Specific conductance (micromhos) | Sulfate (ppm) | Chloride (ppm) | Hardness (ppm) | |
| Tonawanda Creek tributaries in Genesee County | 200 to 300 | 25 to 35 | 5 to 25 | 60 to 140 | |
| Tonawanda Creek downstream from Batavia | 356 to 467 | 33 to 94 | -- | -- | Strongly affected by residual ground water stored in channels and poorly drained areas. |
| Mud Creek basin | 89 to 217 | 19 to 40 | 3.5 to 9.0 | 33 to 94 | |
| North-flowing Tonawanda Creek tributaries, a few miles downstream from Murder Creek to Ellicott Creek. | 148 to 1,000 | -- | -- | -- | Only four sites sampled. Possible pollution and inadequate dilution. |
| Tributaries to Tonawanda Creek and Barge Canal west of Barge Canal. | 228 to 356 | 40+ | 18 | 100 to 130 | |
| Headwaters of Ellicott Creek. | 100 | 20 | 5 | 40 | |
| Ellicott Creek between Mill Grove and Williamsville. | 212 to 300 | 35 to 40 | -- | -- | Effect of ground water still apparent. |

# CHEMICAL QUALITY OF STREAMS DURING PERIOD OF BASE FLOW

The concentration of dissolved solids in streams commonly is highest when streamflow is very small because the chemical quality is almost entirely the result of ground-water discharge. Low streamflows in the Erie-Niagara basin occur during much of the summer and early fall. Rates of evaporation are also highest in the summer and tend to increase even more the concentrations of dissolved solids.

The term base flow is applied in this discussion to those streamflow conditions when all or most of the flow is supplied by ground water. If there is no snow cover, base-flow conditions are quickly reestablished after a rainfall. For small streams with drainage areas of several square miles, ground water is the predominant source of the flow at all times except for just a few hours or days after a rainfall. In the lower reaches of the larger streams in the area, it may take a week or more after a rainfall before ground water again predominates in the streamflow.

During long periods of little or no precipitation, especially during the summer or early fall, the chemical quality of water in streams approaches that of the average shallow ground water of the area, with some modification by evaporation and deeper ground water. In order to determine the chemical quality of streams at base flow, about 200 samples were collected throughout the Erie-Niagara basin on July 2, 4, and 5, 1963. Locations of sampling sites are among those shown in plate 1. The analyses of all samples are given in table 18, and more detailed analyses of some samples are given in table 19. The analyses are summarized on the last two lines of table 5. The local weather conditions prior to and during the sampling are shown in table 9.

In the northern part of the study area (almost all the Tonawanda Creek basin and much of the immediately adjacent areas to the south), most of the samples were collected on July 2, 1963. At this time the smaller streams were under base-flow conditions. However, the main stem of Tonawanda Creek still contained some water from the small but intense rainfalls which occurred in the southeast corner of the area on June 28 and 29, and which affected the headwaters of Tonawanda, Buffalo, and Cattaraugus Creek basins. In the afternoon of July 2, a fairly general storm occurred over most of the Erie-Niagara basin, ranging from less than 0.5 inch of rain in the southwestern and central sections of the area to nearly 2 inches at Lockport. At this time sampling was stopped. Sampling was resumed on July 4, by which time most of the smaller streams had returned to base-flow conditions. Sampling on July 4 and 5 was mostly in the southern part of the area, the part which was least affected by the rain of July 2.

Table 9.--Precipitation and air temperature preceding and during sampling of streams at low flows, June 16 to July 12, 1963 (U.S. Weather Bureau, 1963a and 1963b)

| Date 1962 | Daily precipitation, in inches (T=trace) | | | | | | | | Daily air temperature, in °F | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Arcade | Batavia | Buffalo Airport | Colden (1 mile north) | Gowanda | Linden | South Wales | Wales | Arcade | | Batavia | | Buffalo Airport | | Colden (1 mile north) | | Gowanda | | South Wales | | | |
| | | | | | | | | | Max. | Min. | Max. | Min. | Max. | Min. | Max. | Min. | Max. | Min. | Max. | Min. | | |
| June 16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 72 | 36 | 76 | 46 | 75 | 46 | 72 | 41 | 72 | 44 | 72 | 42 | | |
| 17 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 74 | 47 | 78 | 51 | 79 | 51 | 75 | 47 | 74 | 49 | 73 | 48 | | |
| 18 | 0 | 0 | T | 0 | 0 | 0 | 0 | 0 | 75 | 46 | 77 | 54 | 78 | 57 | 76 | 48 | 75 | 51 | 75 | 52 | | |
| 19 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 80 | 40 | 85 | 49 | 84 | 52 | 84 | 44 | 76 | 46 | 77 | 45 | | |
| 20 | 0 | 0 | T | T | .01 | 0 | 0 | 0 | 66 | 52 | 83 | 67 | 75 | 51 | 76 | 59 | 84 | 65 | 83 | 50 | | |
| 21 | .35 | T | T | T | 0 | 0 | T | 0 | 66 | 42 | 69 | 45 | 64 | 47 | 64 | 44 | 74 | 46 | 74 | 43 | | |
| 22 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 69 | 39 | 72 | 46 | 71 | 48 | 69 | 37 | 62 | 41 | 63 | 42 | | |
| 23 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 78 | 36 | 82 | 49 | 80 | 49 | 80 | 41 | 70 | 44 | 69 | 43 | | |
| 24 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 83 | 41 | 88 | 49 | 88 | 48 | 86 | 42 | 79 | 46 | 80 | 44 | | |
| 25 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 85 | 41 | 90 | 53 | 89 | 52 | 87 | 48 | 88 | 53 | 86 | 50 | | |
| 26 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 87 | 43 | 90 | 54 | 88 | 55 | 89 | 49 | 87 | 52 | 86 | 50 | | |
| 27 | 0 | T | T | 0 | 0 | .10 | 0 | 0 | 88 | 50 | 92 | 65 | 90 | 63 | 91 | 54 | 89 | 62 | 90 | 57 | | |
| 28 | .60 | 0 | .05 | T | 0 | 0 | 0 | 2.26 | 90 | 55 | 91 | 65 | 91 | 62 | 90 | 59 | 91 | 62 | 91 | 56 | | |
| 29 | .01 | T | 0 | T | .50 | 0 | 0 | 0 | 84 | 62 | 92 | 69 | 91 | 60 | 89 | 63 | 94 | 67 | 93 | 64 | | |
| 30 | .12 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 87 | 57 | 94 | 65 | 94 | 63 | 96 | 62 | 89 | 66 | 89 | 60 | | |
| July 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 89 | 59 | 94 | 67 | 93 | 68 | 93 | 63 | 91 | 65 | 91 | 62 | | |
| 2 | 0 | 1.28 | 1.00 | .73 | 0 | 0 | 0 | 1.49 | 89 | 62 | 92 | 65 | 87 | 65 | 92 | 63 | 91 | 71 | 91 | 65 | | |
| 3 | a/ .46 | 0 | 0 | T | 0 | a/1.10 | a/ .01 | 0 | 77 | 51 | 72 | 53 | 72 | 55 | 70 | 49 | 91 | 57 | 91 | 52 | | |
| 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 72 | 40 | 77 | 48 | 74 | 51 | 71 | 39 | 70 | 48 | 70 | 44 | | |
| 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 76 | 45 | 78 | 56 | 79 | 58 | 75 | 43 | 75 | 52 | 74 | 53 | | |
| 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 77 | 39 | 77 | 46 | 78 | 47 | 78 | 42 | 77 | 46 | 78 | 42 | | |
| 7 | .02 | T | T | .38 | 0 | 0 | 0 | .03 | 82 | 50 | 79 | 59 | 75 | 60 | 82 | 53 | 82 | 61 | 79 | 49 | | |
| 8 | 0 | 0 | 0 | 0 | T | .04 | .09 | 0 | 70 | 53 | 78 | 56 | 65 | 51 | 70 | 55 | 83 | 58 | 81 | 54 | | |
| 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 68 | 34 | 70 | 42 | 69 | 47 | 70 | 37 | 66 | 41 | 68 | 37 | | |
| 10 | 0 | 0 | 0 | T | 0 | 0 | 0 | 0 | 70 | 47 | 73 | 53 | 74 | 58 | 70 | 52 | 70 | 55 | 70 | 45 | | |
| 11 | 0 | 0 | 0 | 0 | 0 | .20 | 0 | 0 | 78 | 52 | 81 | 58 | 81 | 60 | 80 | 54 | 72 | 56 | 70 | 52 | | |
| 12 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 84 | 48 | 85 | 55 | 86 | 55 | 86 | 50 | 81 | 54 | 80 | 51 | | |

a/ Rainfall occurred late on July 2, but was reported for following day when rain gages were serviced.

## AREAL VARIATIONS

A regional picture of the water quality of small streams at base flow is shown in figure 5, based on specific conductance dterminations at about 200 sites. Dissolved-solids content for the corresponding areas shown on the map would be roughly two-thirds of the specific conductance. Figure 5 should be compared with figure 1, from which it is evident that the most mineralized water is discharged from the Camillus Shale, which contains gypsum (calcium sulfate). The next most mineralized water is discharged from the limestone and dolomite units which crop out south and north of the Camillus Shale. There are many local variations in water quality, corresponding mainly to local differences in composition of the rocks and glacial deposits, the character of the ground water flow system, and pollution.

The area as a whole may be divided into two main parts, with respect to chemical quality of water in streams: the Tonawanda Creek basin west of Batavia with its more mineralized water, and the remainder of the streams of the region with their lesser mineralized water. The following ranges of values in parts per million (from table 5, which in part is a summary of tables 18 and 19) are representative of most of the data obtained during the low-flow sampling of July 1963.

| | Tonawanda Creek basin west of Batavia | Other parts of Lake Erie-Niagara area |
|---|---|---|
| Calcium | 85 - 165 ppm | 44 - 61 ppm |
| Sulfate | 37 - 1,190 ppm | 21 - 80 ppm |
| Chloride | 22 - 107 ppm | 5 - 53 ppm |
| Dissolved solids | 410 - 717 ppm | 170 - 296 ppm |
| Specific conductance | 409 - 2,070 micromhos | 286 - 599 micromhos |
| Hardness as $CaCO_3$ | 163 - 1,410 ppm | 126 - 244 ppm |
| pH | 7.3-7.9 | 7.0-8.3 |

Most of the streams in the Erie-Niagara basin contain water of the calcium-bicarbonate type; the exceptions are streams in the lower Tonawanda Creek basin, where the water is mainly of the calcium-sulfate type. Waters near the borders of this basin are mixtures of the two chemical types.

## VARIATIONS ALONG A SINGLE STREAM

The natural chemical quality of a single stream at base flow may remain much the same throughout its length, or may change significantly at downstream points, depending on whether the chemical quality of most of the contributing ground water remains about the same or differs downstream. Examples of these situations are shown in figure 6. Note that there is relatively little change in chemical quality of Cattaraugus Creek throughout much of its length, a consequence of the fact that there is relatively little variation in the ground-water quality throughout the Cattaraugus Creek basin. The increased dissolved-solids content at Gowanda results

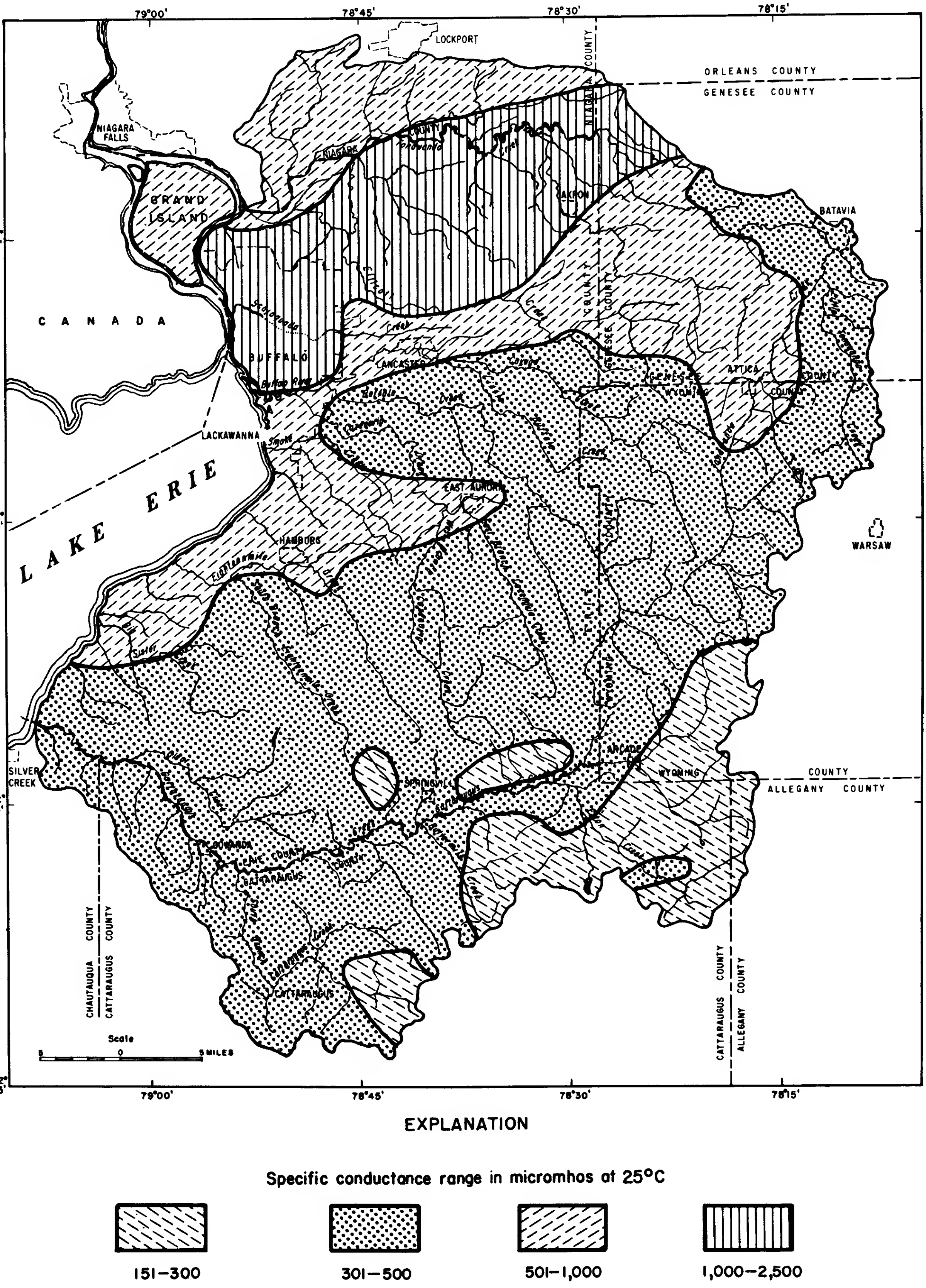
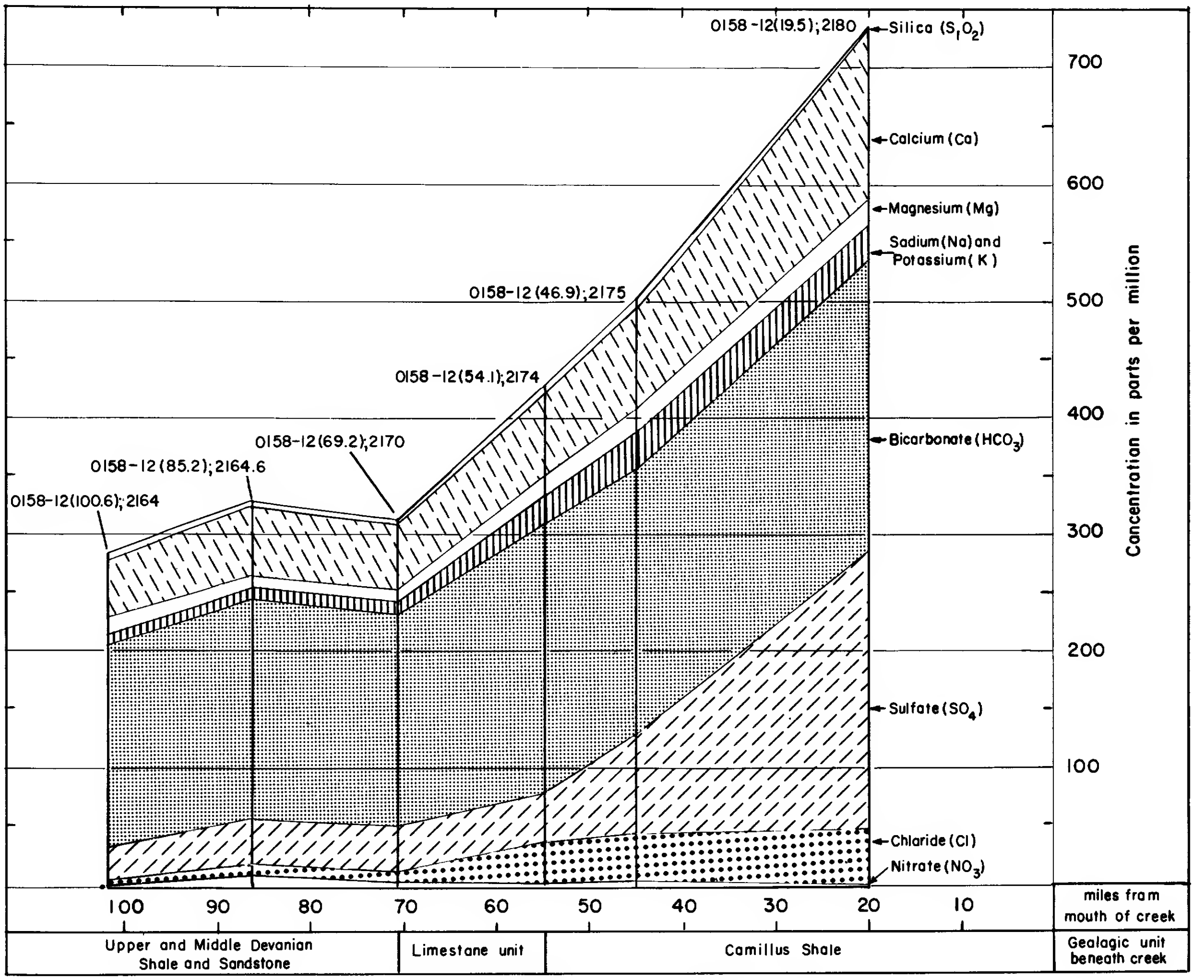
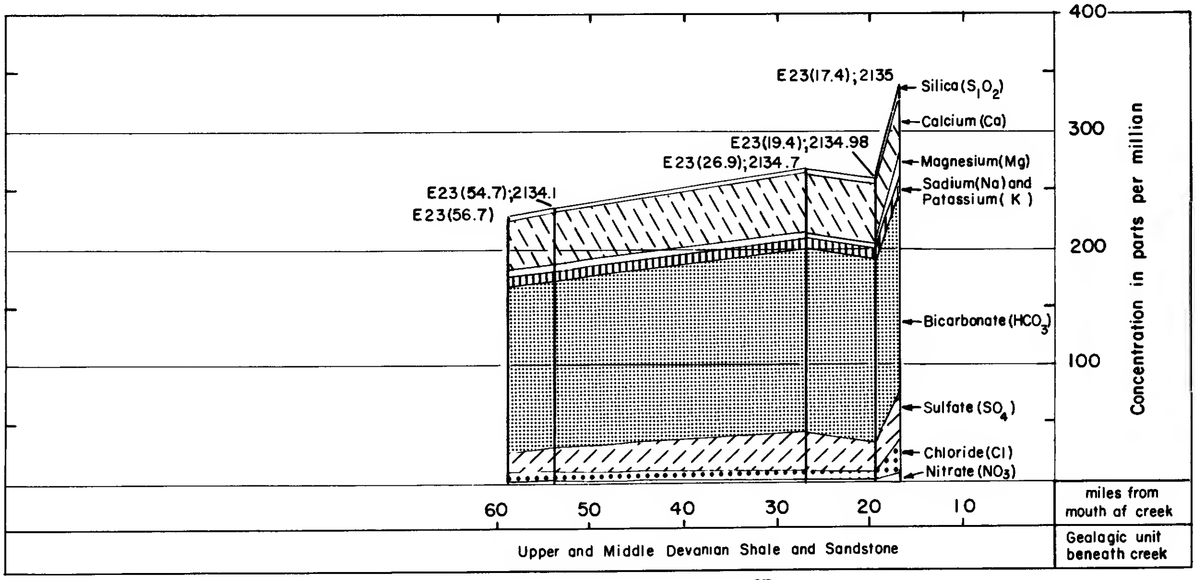



Figure 5.--Specific conductance of small streams at 75 to 95 percent flow duration.




TONAWANDA CREEK—JULY 2, 1963




CATTARAUGUS CREEK—JULY 2-5, 1963

Figure 6.--Variation in chemical quality of water in Cattaraugus and Tonawanda Creeks, July 2-5, 1963.

mainly from pollution. On the other hand, the graph of Tonawanda Creek shows significant chemical changes in a downstream direction, a result of associated changes in geology and ground water discussed in previous sections of this report. Note especially the increase in sulfate, as the stream flows across the area underlain by the Camillus Shale.

In addition to the similarities or differences along major streams referred to above, there are sometimes very noticeable local changes in chemical quality of small streams within short distances. South-flowing Dresser and Hyler Creeks in the Cattaraugus Creek basin (west of Arcade) are examples of this type of change. The streams were samples on July 4, 1963, upstream and downstream from the last major drop in elevation before entering Cattaraugus Creek. In these streams the following increases in both mineral concentrations (in parts per million) and discharge rates (cubic feet per second) were observed within a distance of 1.5 miles:

| | Dresser Creek | | Hyler Creek | |
|---|---|---|---|---|
| | Upstream | Downstream | Upstream | Downstream |
| Sulfate (ppm) | 25 | 43 | 19 | 35 |
| Hardness as $CaCO_3$ (ppm) | 137 | 180 | 75 | 134 |
| Stream discharge (cfs) | 0.148 | 0.272 | 0.224 | 0.417 |

To cause this increase in the mineral content of the stream water, the ground water which causes the increased flow at or near the downstream sampling sites on these streams must contain 50 to 70 ppm of sulfate, and 200 to 230 ppm of hardness. This more mineralized ground water probably has a longer and deeper path of underground travel to the streams than that of the ground water contributing to the upstream reaches. Also part of the path of travel was probably through rocks containing minerals more soluble than those found in rocks near the land surface.

# CHANGE IN CHEMICAL QUALITY OF STREAMS WITH CHANGE IN FLOW

Previous sections of this report have shown the extremes of chemical quality of streams in the Erie-Niagara basin, and the reasons for the extremes. Thus, the dissolved-mineral content varies from generally low values, after heavy precipitation or a general thaw, to somewhat or considerably higher values during extended dry-weather periods. Between these extremes are many day-to-day variations which are not readily predictable without additional information on the chemical quality and flow of the streams. The main daily variations are caused by slowly but constantly changing rate of ground-water discharge and the irregular occurrence (both in time and in magnitude) of precipitation. In turn, the erratic occurrence of precipitation, along with such related factors as conditions of soil moisture, topography, vegetation, and air and water temperatures, determines the irregular rate of overland flow.

## MEASURED VARIATIONS

Only two sites in the Erie-Niagara basin have been sampled for chemical quality on a daily or monthly basis -- Cattaraugus Creek at Gowanda and Buffalo Creek at Gardenville. Prior to 1963, daily sampling at these sites and at two others close to the area was done by the U.S. Geological Survey in cooperation with the New York State Department of Commerce, as summarized below:

| Site | State site number<br>USGS site number | Period of sampling | Chemical analyses in |
|---|---|---|---|
| Cattaraugus Creek at Gowanda | E23(17.4)<br>2135 | Oct.1958 to Sept.1959 (daily) | Table 20 |
| Buffalo Creek at Gardenville | E1(10.4)<br>2145 | Oct.1961 to Sept.1962 (daily) | Table 21 |
| Niagara River at Niagara Falls | 0.58(19.6)<br>2160 | Oct.1958 to Sept.1959 (daily) | Table 22 |
| Erie (Barge) Canal at Lock 35, at Lockport | E230(0.8)<br>2196 | Oct.1958 to Sept.1959 (monthly) | Table 23 |
| | | Oct.1961 to Sept.1962 (daily) | Table 23 |

The data for the Niagara River and for the Erie (Barge) Canal are tabulated in the back of this report.

At the daily sites, the specific conductance and pH of each daily sample are measured. During each calendar month the samples that have similar conductance and pH values on consecutive days are combined into a single sample for analysis of other chemical constituents. This procedure reduces the cost of analytical work but still produces accurate and representative information on the chemical quality of the stream.

The water in Cattaraugus Creek at Gowanda and in Buffalo Creek at Gardenville is of the calcium bicarbonate type. Graphs of daily specific conductance and daily streamflow for 1 year at these two sites are given in figures 7 and 8. As noted in previous sections, the specific conductance gives an indication of the dissolved-solids content. Often, the dissolved-solids content, in parts per million, is between 60 and 70 percent of the specific conductance in micromhos.

As is to be expected, the specific conductance tends to decrease when streamflow increases (high proportion of overland flow), and conversely, the specific conductance tends to increase when the streamflow decreases (high proportion of ground water). Most of the high streamflows are during the spring and during winter thaws, although some occur at other times of the year during unusually heavy rains; at almost all such times the specific conductance is reduced. During dry periods of the summer and fall, streamflow gradually decreases, and specific conductance gradually increases.

Note on the graph for Cattaraugus Creek (fig. 7), that variation in the specific conductance is considerable even during periods of low streamflow. This is, at least in part, the result of pollution, which adds to the variability of the stream quality. Some of the winter and spring variations in specific conductance of Buffalo Creek (fig. 8), such as on February 4, 1962, are thought to be due to "slug" pollution from road salt that is carried in snowmelt runoff, or is released by ice-jam breakup. Table 10 shows the frequency of occurrence of selected values of specific conductance at the Gowanda and Gardenville sites, for the 1 year of daily sampling.

Other chemical-quality data that are available for specific stream locations are listed in table 19. This table presents the complete analysis for more than 30 sites. Each site has 2 to 5 analysis and has usually been sampled at times of moderate or moderately low streamflow. These analyses generally represent the range of the most frequently occurring streamflow, and therefore the chemical quality that occurs the greater part of the time at each site. The greatest deficiencies of chemical data are in the moderately high range of streamflow.

## COMPUTED STREAMFLOW QUALITY

Ordinarily streamflow is a mixture of ground water and overland flow. The volumes and proportions of ground water and overland flow in this mixture are continuously varying. If it can be assumed that ground water and overland flow of a given area have "distinctive quality" and that the

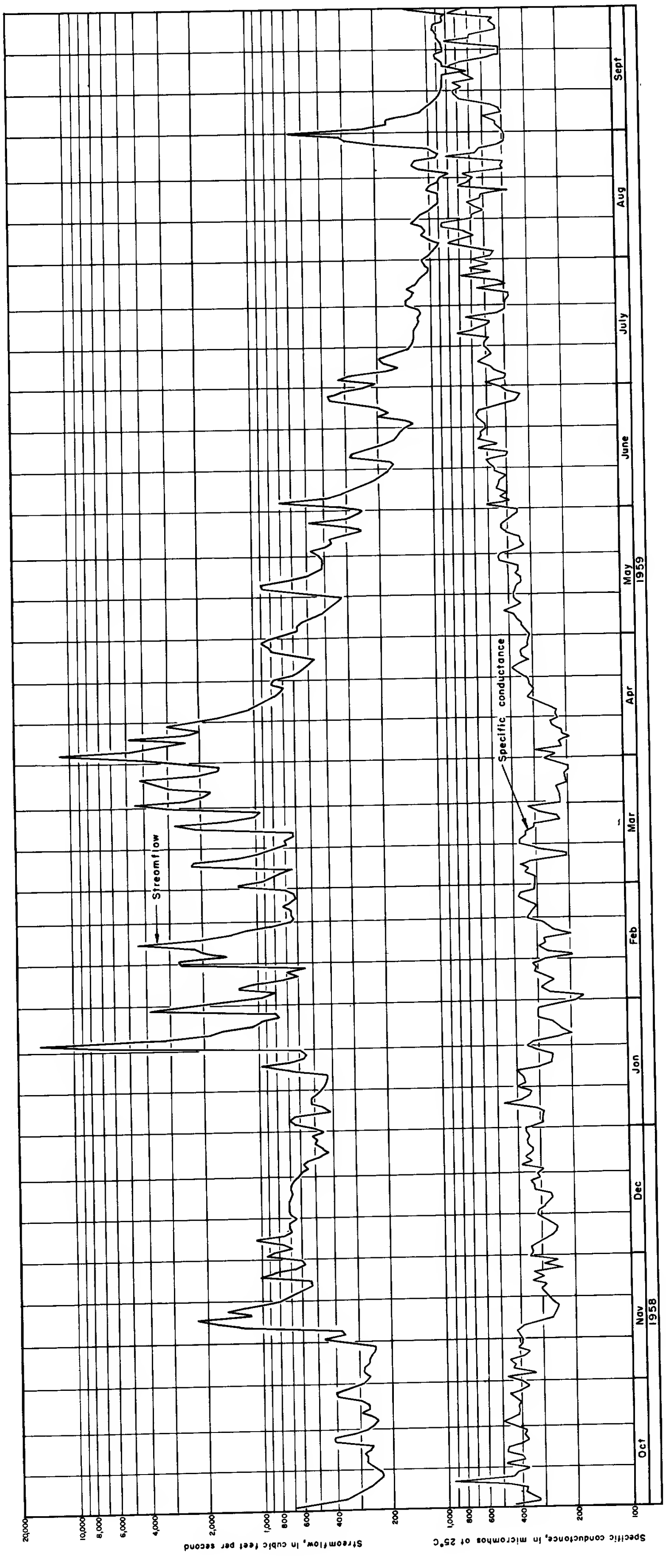



Figure 7.--Specific conductance and daily mean streamflow, Cattaraugus Creek at Gowanda, October 1, 1958 to September 30, 1959.

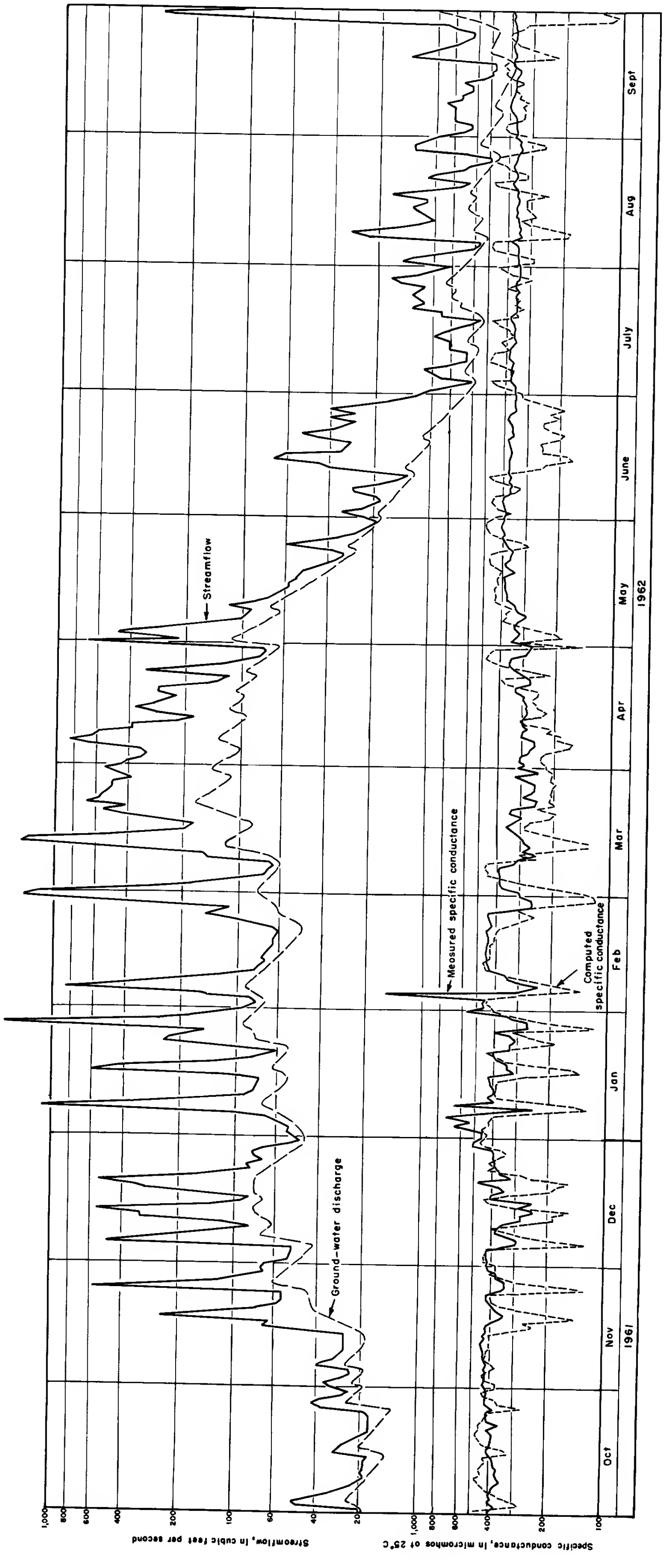



Figure 8.--Measured and computed specific conductance, measured streamflow, and estimated ground-water discharge, Buffalo Creek at Gardenville, October 1, 1961 to September 30, 1962.

Table 10.--Frequency of selected values of specific conductance, Cattaraugus Creek at Gowanda, October 1958 to September 1959, and Buffalo Creek at Gardenville, October 1961 to September 1962

Percent of time specific conductances of daily samples were equal to or less than that shown

BY "PERCENT-OF-DAYS" INTERVALS

| Percent of days | Cattaraugus Creek at Gowanda (micromhos) | Buffalo Creek at Gardenville (micromhos) |
|---|---|---|
| 1 | 190 | 250 |
| 10 | 242 | 290 |
| 25 | 300 | 330 |
| 50 | 360 | 360 |
| 75 | 440 | 390 |
| 90 | 568 | 430 |
| 99 | 830 | 540 |

BY "MICROMHOS" INTERVALS

| Micromhos | (Percent of days) | (Percent of days) |
|---|---|---|
| 200 | 3 | -- |
| 250 | -- | 1 |
| 300 | 25 | 14 |
| 350 | -- | 38 |
| 400 | 65 | 80 |
| 450 | -- | 96 |
| 500 | 82 | 97 |
| 550 | -- | 99 |
| 600 | 93 | -- |
| 700 | 96 | -- |
| 800 | 98 | -- |

chemical quality of the streamflow in that area depends on the relative proportion of each, then the chemical quality of the streamflow can be determined by measuring the quality and quantity of each of the two components. Meinzer and Stearns (1929, p. 111-113) intimated that such assessment was logical.

Specific conductance or many other chemical-quality parameters can be computed for some streams with an accuracy of about 5 to 20 percent, by using the types of data found in this report and the Survey's reports on streamflow (Harding and Gilbert, 1968) and ground water (LaSala, 1968). Computations in this report were made by use of the following formula:

$$S_q \times S_c = (G_q \times G_c) + (O_q \times O_c)$$

which becomes:

$$S_c = \frac{(G_q \times G_c) + (O_q \times O_c)}{S_q}$$

where $S_q$ = streamflow

$S_c$ = streamflow quality characteristic (micromhos or ppm)

$G_q$ = ground-water discharge

$G_c$ = ground-water quality characteristic (micromhos or ppm)

$O_q$ = overland-flow discharge

$O_c$ = overland-flow quality characteristic (micromhos or ppm).

Ground-water discharge is estimated by use of a ground-water rating curve based on correlations of streamflow data with water levels in observation wells. The ground-water and overland-flow quality characteristics are those chemical or chemical-related values obtained, respectively, during periods of base flow (table 18) and overland flow (table 16) or very high streamflow (table 17).

The accuracy of these methods of computation is obviously limited by how accurately and how well the collected samples represent the characteristics of the stream; do the chemical-quality, streamflow, and ground-water discharge data used in the computation typify actual conditions? Furthermore, the assumption of typical conditions requires relative uniformity of the climatic, physical, and geologic environments of the stream basin upstream from the point for which the computations are being made. The larger the upstream basin, the less uniform the conditions. Therefore, the computations are more likely to be valid for small stream

basins than for large ones. In a larger basin, for example, a rainfall producing a certain streamflow may occur mainly in a part of a basin that has low dissolved-mineral characteristics; and a second rainfall may produce the same streamflow at the same measuring site, but the rainfall may occur mainly over a different part of the basin, a part having higher dissolved-mineral characteristics.

Another factor to be kept in mind with respect to computations using these kinds of data is that the chemical samples are so-called grab samples, that is, sampled at a particular instant in time, whereas the type of streamflow data used in each computation is the mean flow for an entire day. At times of relatively constant flow, the difference between a grab sample and the mean sample would usually not affect the accuracy of the computation; but, at times of variable flow or soon after release of polluted matter in a stream, the selection of the representative values for quality and quantity are much more difficult, and accuracy may be somewhat low. A grab sample taken during a period of rapidly changing streamflow likewise may not be representative of the average daily quality.

## SPECIFIC CONDUCTANCE, DAILY VALUES

Computations of specific conductance, of the type described in the preceding section, were made for the following sites, and graphs of the data are shown in the figures indicated, each for the 12-month period ending September 30, 1962, except Cattaraugus Creek which is for the year ending September 30, 1964:

| | |
|---|---|
| Cattaraugus Creek near Arcade (drainage area, 78.4 square miles) | Figure 9 |
| Buttermilk Creek near Springville (drainage area, 29.3 square miles) | Figure 10 |
| Little Tonawanda Creek at Linden (drainage area, 22.1 square miles) | Figure 11 |
| Buffalo Creek at Gardenville (drainage area, 145 square miles) | Figure 8 |

The first three sites noted above represent small drainage areas, each of which has a relatively uniform hydrologic environment; the fourth site represents a larger area and a more varied physical and geologic environment.

The following specific-conductance values were chosen for the overland-flow and ground-water quality characteristics:

| | Specific conductance | |
|---|---|---|
| | Overland flow (micromhos) | Ground water (micromhos) |
| Cattaraugus Creek near Arcade | 85 | 300 |
| Buttermilk Creek near Springville | 80 | 250 (for 16 cfs or more) to 620 (for 1 cfs or less) |
| Little Tonawanda Creek at Linden | 150 | 420 |
| Buffalo Creek at Gardenville | 95 | 500 |

Chemical data for Buttermilk Creek indicate a progressive increase in the dissolved-solids content of discharging ground water as the rate of ground-water discharge decreases. This change in quality is believed to be explained by the creek receiving a fairly constant, but small, discharge of deeply circulating ground water that is high in dissolved solids. As the discharge of shallow-circulating ground water that is lower in dissolved solids decreases, the overall concentration in the discharging ground water increases. A straight-line relationship was assumed between the specific conductance of 250 micromhos at 16 cfs and 620 micromhos at 1 cfs.

The applicability of this method of computation and of the data shown above were checked by comparing computed values with measured values for each site. These comparisons are shown in table 11. The average difference between the computed and measured values at the Arcade site was 24 micromhos (or 12 percent), at the Springville site 14 micromhos (or 5 percent), and at the Linden site 18 micromhos (or 6 percent). At the Springville site, no high-flow samples with the necessary discharge data were available for comparison with the computed values. These relatively small differences indicate that the method of computation is valid for these three sites, at least for low and moderate flows, and that representative values were chosen for the specific conductance of the overland flow and of ground water. The specific conductance graphs (figs. 9, 10, and 11) for these sites are probably substantially correct for periods of little variation in streamflow, but the accuracy is no doubt diminished during periods of sharply changing streamflow.

The site on Buffalo Creek at Gardenville and a site on Cattaraugus Creek at Gowanda are the only two places in the Erie-Niagara basin for which daily measured conductance values are available for a full year. Because of the lesser effect of pollution, the Gardenville site was chosen for computation of daily conductance values to be compared with the measured values. The measured and computed conductances are shown in figure 8. Table 11 compares the differences between measured and computed values of specific conductance. The agreement of the measured

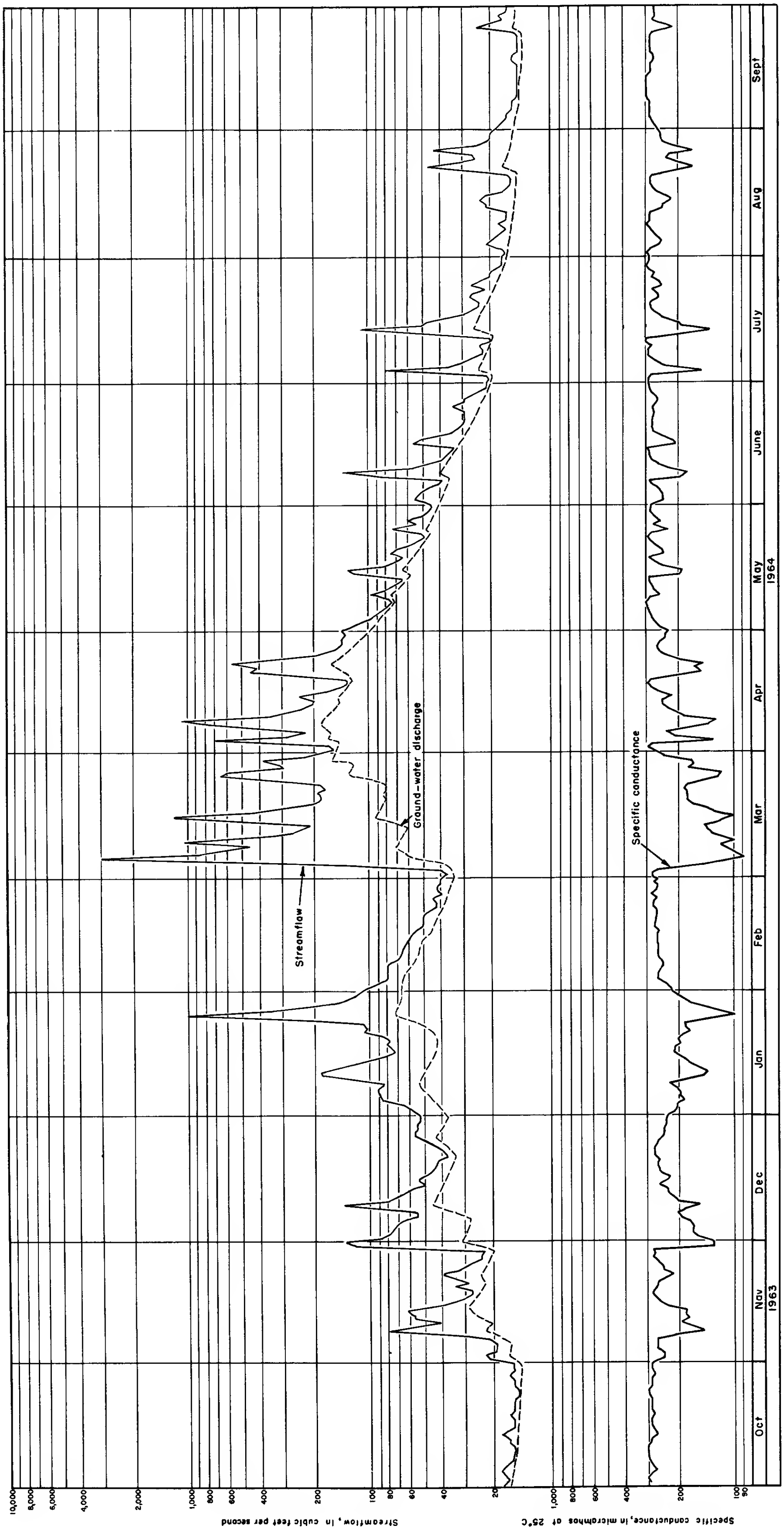



Figure 9.--Computed specific conductance, measured streamflow, and estimated ground-water discharge, Cattaraugus Creek near Arcade, October 1, 1963 to September 30, 1964.

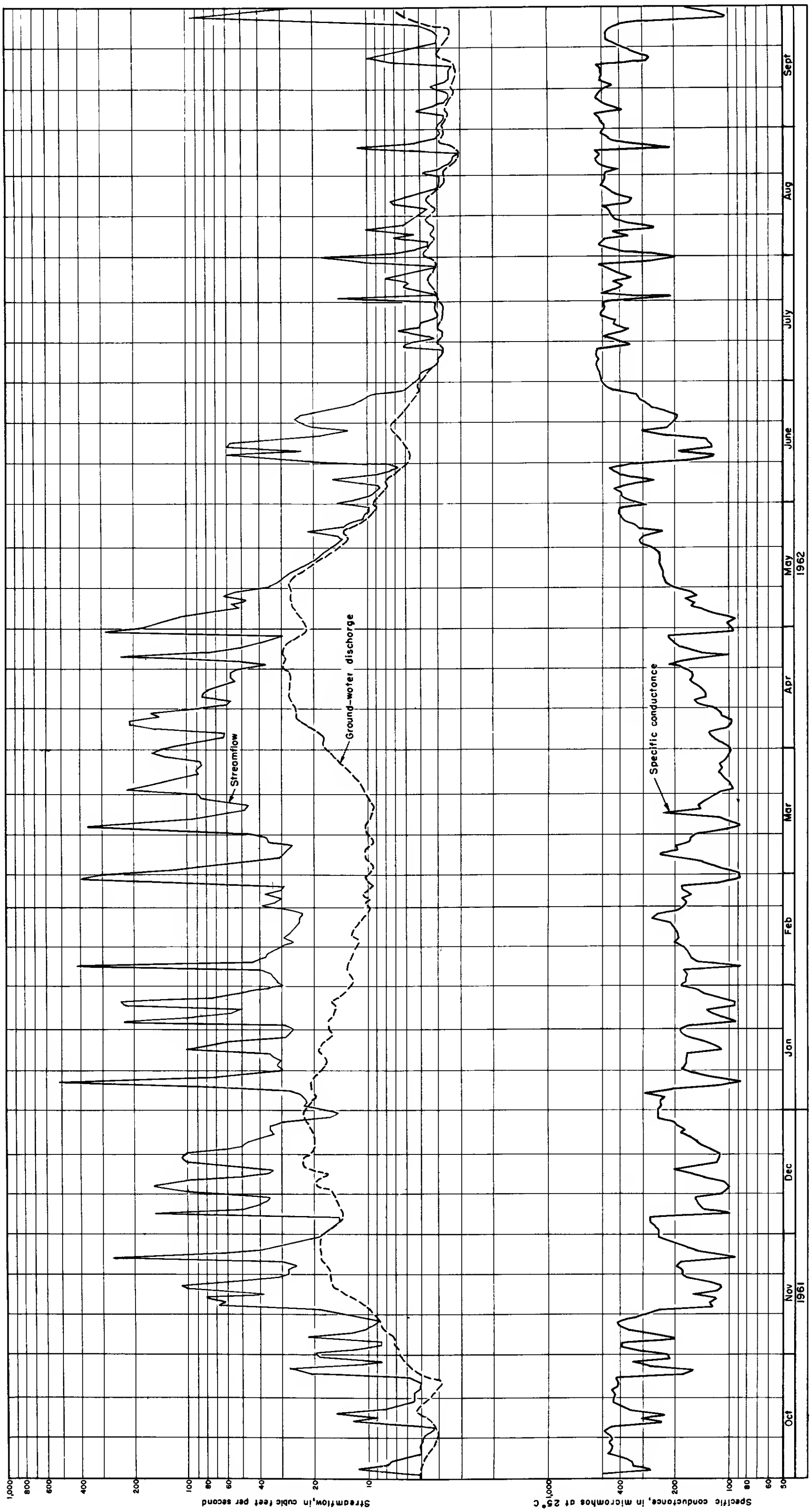



Figure 10.--Computed specific conductance, measured streamflow, and estimated ground-water discharge, Buttermilk Creek near Springville, October 1, 1961 to September 30, 1962.

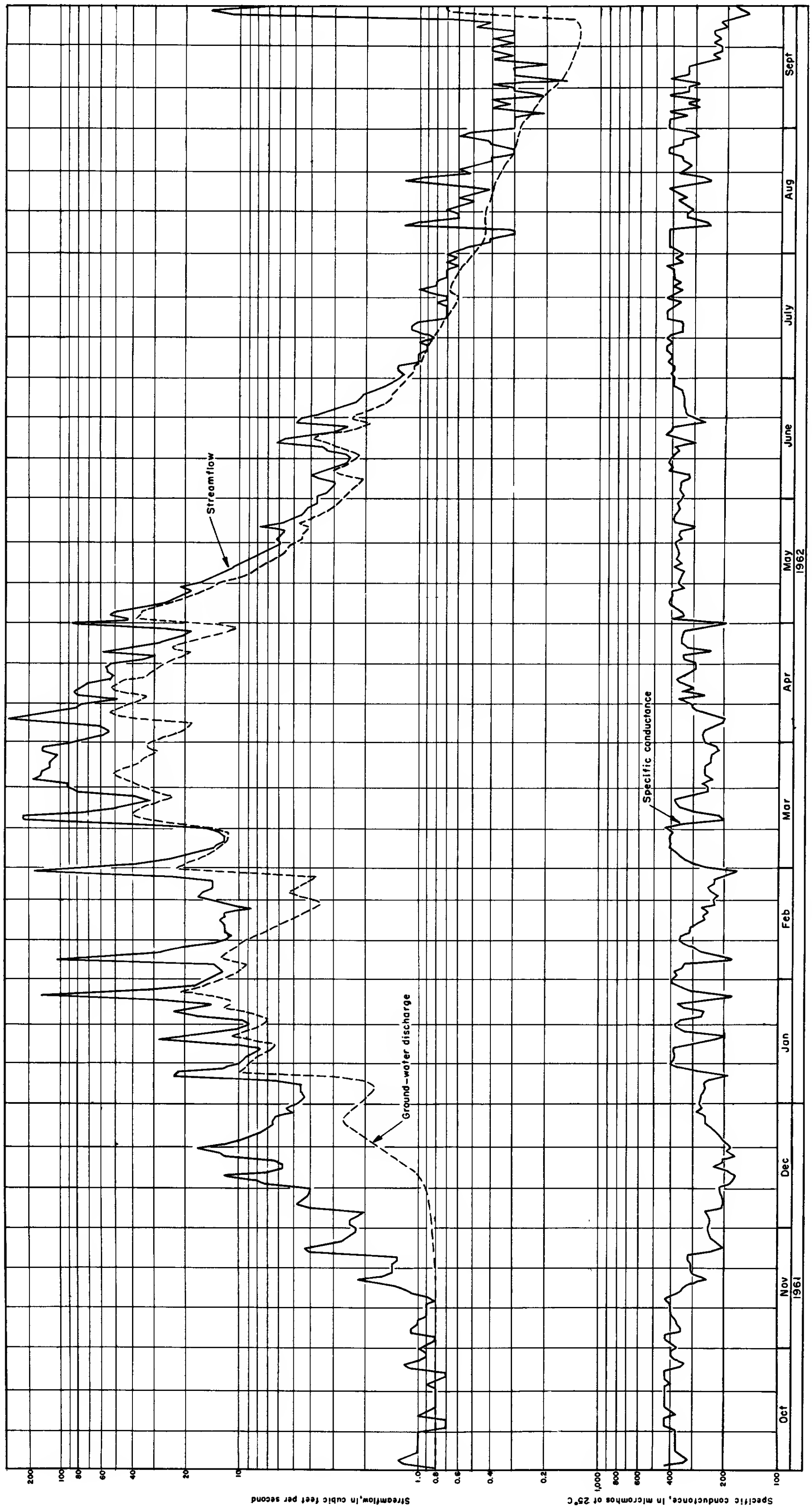



Figure 11.--Computed specific conductance, measured streamflow, and estimated ground-water discharge, Little Tonawanda Creek at Linden, October 1, 1961 to September 30, 1962.

Table 11.--Comparison of computed values of specific conductance with measured values at each of four stream sites

| Date of sample | Discharge (cfs): Instantaneous streamflow | Discharge (cfs): Overland flow | Discharge (cfs): Ground water | Specific conductance (micromhos): Ground water | Specific conductance (micromhos): Streamflow computed | Specific conductance (micromhos): Streamflow measured |
|---|---|---|---|---|---|---|
| | | | Cattaraugus Creek near Arcade | | | |
| 3-20-63 | 848 | 648 | 200 | -- | 136 | 170 |
| 4-17-63 | 102 | 6 | 96 | -- | 287 | 278 |
| 5- 7-63 | 70 | 5 | 65 | -- | 285 | 288 |
| 7- 2-63 | 30.5 | 7.5 | 23 | -- | 247 | 295 |
| 3- 5-64 | 3,270 | 3,215 | 55 | -- | 98 | 126 |
| | | | Buttermilk Creek near Springville | | | |
| 5-18-62 | 15.7 | .7 | 15 | 260 | 252 | 245 |
| 10- 8-62 | 4.8 | 2.5 | 2.3 | 580 | 320 | 334 |
| 2- 4-63 | a/19 | a/3 | 16 | 250 | b/223 | 233 |
| 5- 7-63 | 15.7 | 3 | 15 | 260 | 238 | 216 |
| 7- 4-63 | 4.99 | 1.39 | 3.6 | 560 | 426 | 445 |
| | | | Little Tonawanda Creek at Linden | | | |
| 5- 8-63 | 9.9 | 4.0 | 5.6 | -- | 303 | 348 |
| 7- 2-63 | 1.84 | .4 | 2 | -- | 420 | 420 |
| 3- 5-64 | 923 | 887 | 36 | -- | 160 | 152 |
| | | | Buffalo Creek at Gardenville | | | |
| 6-20-51 | 27 | 7 | 20 | -- | 395 | 339 |
| 8-13-56 | 36 | 25 | 11 | -- | 218 | 347 |
| 4-10-61 | 1,110 | 1,010 | 100 | -- | 131 | 210 |
| 8-21-61 | 32 | 17 | 15 | -- | 285 | 378 |
| 1- 6-62 | 160 | 113 | 47 | -- | 214 | 427 |
| 1- 7-62 | 1,030 | 982 | 48 | -- | 114 | 242 |
| 1- 8-62 | 256 | 208 | 48 | -- | 171 | 628 |
| 2- 4-62 | 180 | 132 | 48 | -- | 203 | c/1,580 |
| 5- 8-63 | 118 | 56 | 62 | -- | 308 | 383 |
| 7- 5-63 | 21.3 | 11.3 | 10 | -- | 285 | 359 |
| 4-16-64 | 122 | 72 | 50 | -- | 261 | 334 |

a/ Mean daily discharge.
b/ Mean conductance.
c/ This sample is believed to be influenced by local pollution and not representative of the stream.

and computed values is poor. The greatest difference between measured and computed conductance occurred when overland flow into the stream exceeded ground-water discharge; generally the measured values were higher. Conversely, when ground-water flow was predominant, measured values generally were less than the computed values.

When fixed values of specific conductance are chosen to describe ground-water flow (500 micromhos in this case) and overland flow (95 micromhos), the method of computation thereby sets the upper and lower limits of specific conductance corresponding respectively to the lowest and highest streamflow. For Gardenville, the maximum possible computed value of 500 micromhos was exceeded by measured values 9 times; ground water was the predominant component of flow 7 of those 9 times.

There are several factors which affect the quality of Buffalo Creek and its tributaries, but these factors are not taken into account in the computations. The Buffalo Creek basin is large and of varied geology. The stream before reaching Gardenville passes from an area of better quality ground water to one of poorer quality. Furthermore, chemical quality of precipitation and overland flow varies with variations in the air pollution over the basin; usually, the upstream part of the basin is less polluted than the downstream part. The 5-mile reach upstream from the sampling site receives little inflow from tributaries or ground water. This reach is a series of pools and riffles in which time of travel is slow enough to allow for the homogeneous mixing of overland runoff and ground water. This slow mixing cuts down on the day-to-day variations of stream-water quality at the sampling site. Because of all these varying factors, Buffalo Creek is not appropriate for computing daily chemical-quality values by the foregoing method. However, all the water that enters the basin must eventually be discharge and all the components from various parts of the basin will tend towards some average value. Eventually, it may be possible to compute values representative of longer periods, perhaps monthly mean values.

Table 12 compares computed and measured daily values of specific conductance. The values agree with an average of 20 percent. If the qualities of discharging ground water and of overland runoff were known more precisely, the computation of specific conductance would be more accurate. The averages by months of the differences between computed and measured daily specific conductance are in close enough agreement to suggest that, even with present data, computations of chemical quality can be made on a monthly basis with sufficient accuracy to be useful to water users.

Table 12.--Differences between measured and computed daily values of specific conductance, Buffalo Creek at Gardenville, October 1961 to September 1962, by months

| Month | Difference in micromhos | | | Difference in percent of measured value | | |
|---|---|---|---|---|---|---|
| | Minimum | Maximum | Average | Minimum | Maximum | Average |
| October 1961 | 9 | 114 | 60 | 2 | 32 | 16 |
| November | 4 | 226 | 61 | 1 | 64 | 16 |
| December | 2 | 329 | 67 | 0 | 69 | 19 |
| January 1962 | 4 | 483 | 103 | 1 | 77 | 25 |
| February | 8 | 187* | 64* | 2 | 60* | 19* |
| March | 37 | 159 | 87 | 4 | 55 | 28 |
| April | 4 | 167 | 72 | 1 | 58 | 25 |
| May | 10 | 139 | 64 | 3 | 43 | 18 |
| June | 15 | 200 | 96 | 5 | 55 | 27 |
| July | 0 | 116 | 42 | 0 | 35 | 12 |
| August | 1 | 160 | 69 | 0 | 47 | 20 |
| September | 7 | 272 | 67 | 2 | 72 | 18 |
| Water year | 0 | 483* | 71* | 0 | 77* | 20* |

* Does not include sample collected February 4, 1962.

## RELATION OF SPECIFIC CONDUCTANCE TO DISSOLVED-SOLIDS CONTENT, SULFATE, AND CHLORIDE

Specific conductance is easily measured either in the field or in the laboratory and is a parameter commonly determined, even to the exclusion of other chemical parameters. As may have been apparent, the preceding discussion was largely concerned with specific conductance, because specific conductance was measured in a large number of samples and was the only parameter for which at least one full year of daily values was available for comparison with daily computed values.

Data on specific conductance are most useful if they can be related to other chemical parameters. In this light, the concentrations of dissolved solids, sulfate, and chloride determined in samples were plotted against corresponding specific conductance, and some relationships were found. Figures 12, 13, and 14 are graphs correlating dissolved solids, sulfate, and chloride with specific conductance in one basin (Buffalo Creek upstream from Gardenville) and in the two major divisions of the Erie-Niagara basin -- the highly mineralized part, underlain by the Camillus Shale, and the much larger but less mineralized part, underlain by less soluble rocks and minerals. A generalized map of these rock units is shown in figure 1. These correlation graphs then may be used to estimate the concentration of dissolved solids, sulfate, and chloride that corresponds to a value of specific conductance.

The graphs are most reliable in the middle and lower ranges of values and less so for the upper values. The chemical data upon which the lines are based are contained in tables 17, 18, and 19. Note that on the graph for the area underlain by the Camillus Shale (fig. 13), each line "breaks" to the right at a specific conductance of 800 micromhos, because each graphed point had a higher chemical concentration-to-conductance ratio above 800 micromhos than below. Below 800 micromhos the graph lines were fairly well defined by the plotted points (not shown); above 800 micromhos the graph lines were poorly defined, and the chemical type of water was more likely to vary. This variation occurs because surface water having a conductance greater than 800 micromhos contains two types of discharged ground water in varying proportions: (1) ground water high in sulfate that has circulated only to shallow depth, and (2) deeply circulated ground water high in chloride.

## DURATION CURVES OF SPECIFIC CONDUCTANCE

The variations in the quality of streamflow over a period of time can be summarized by duration curves. Figures 15, 16, 17, and 18 present chemical-quality duration curves that show the percent of time the specific conductance was equal to or less than the specific conductance values shown on the graph. The duration curves for streamflow were obtained from the Erie-Niagara basin report on streamflow by Harding and Gilbert (1968),

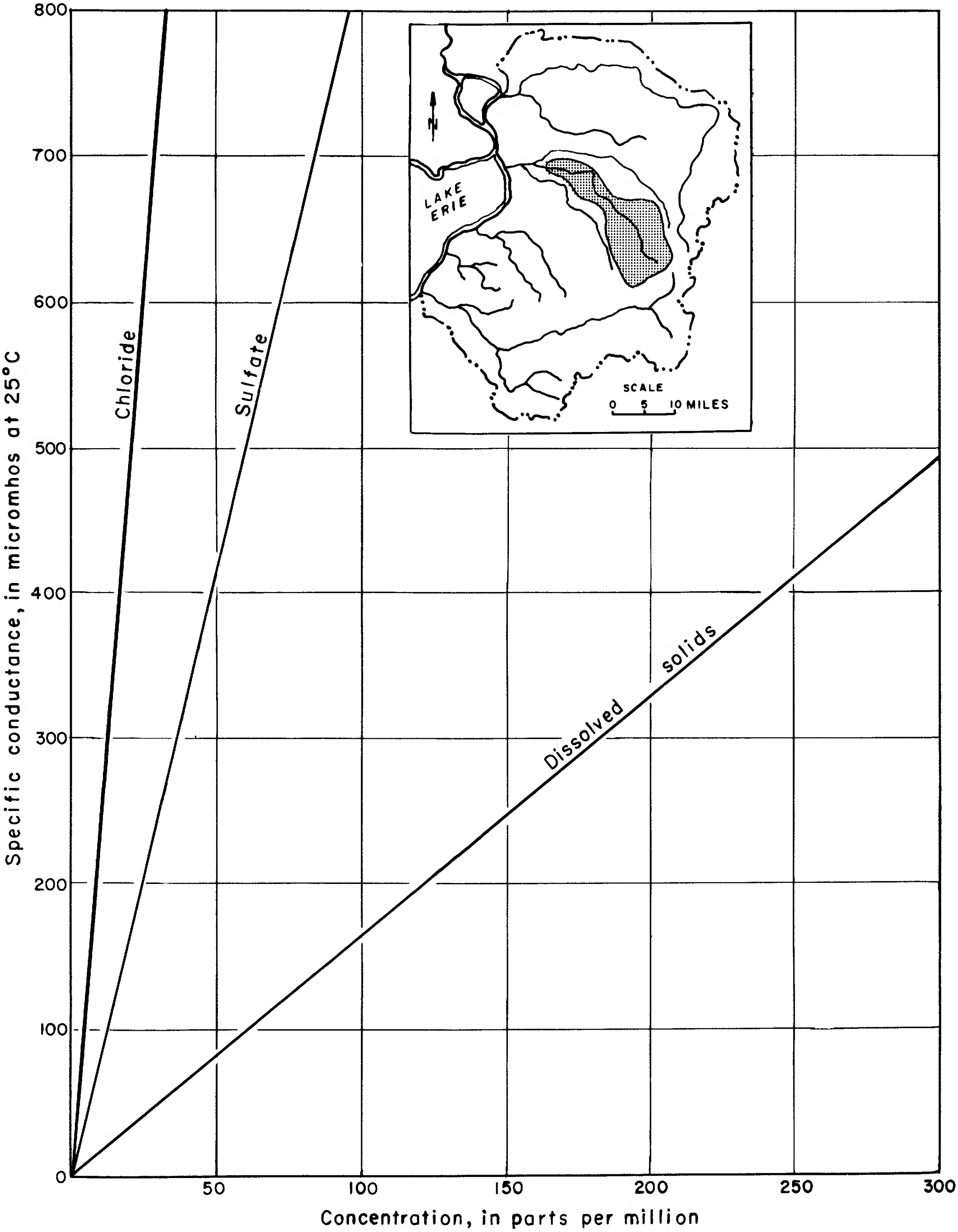



Figure 12.--Relation of specific conductance to selected chemical parameters of water in Buffalo Creek at Gardenville, October 1961 to September 1962.

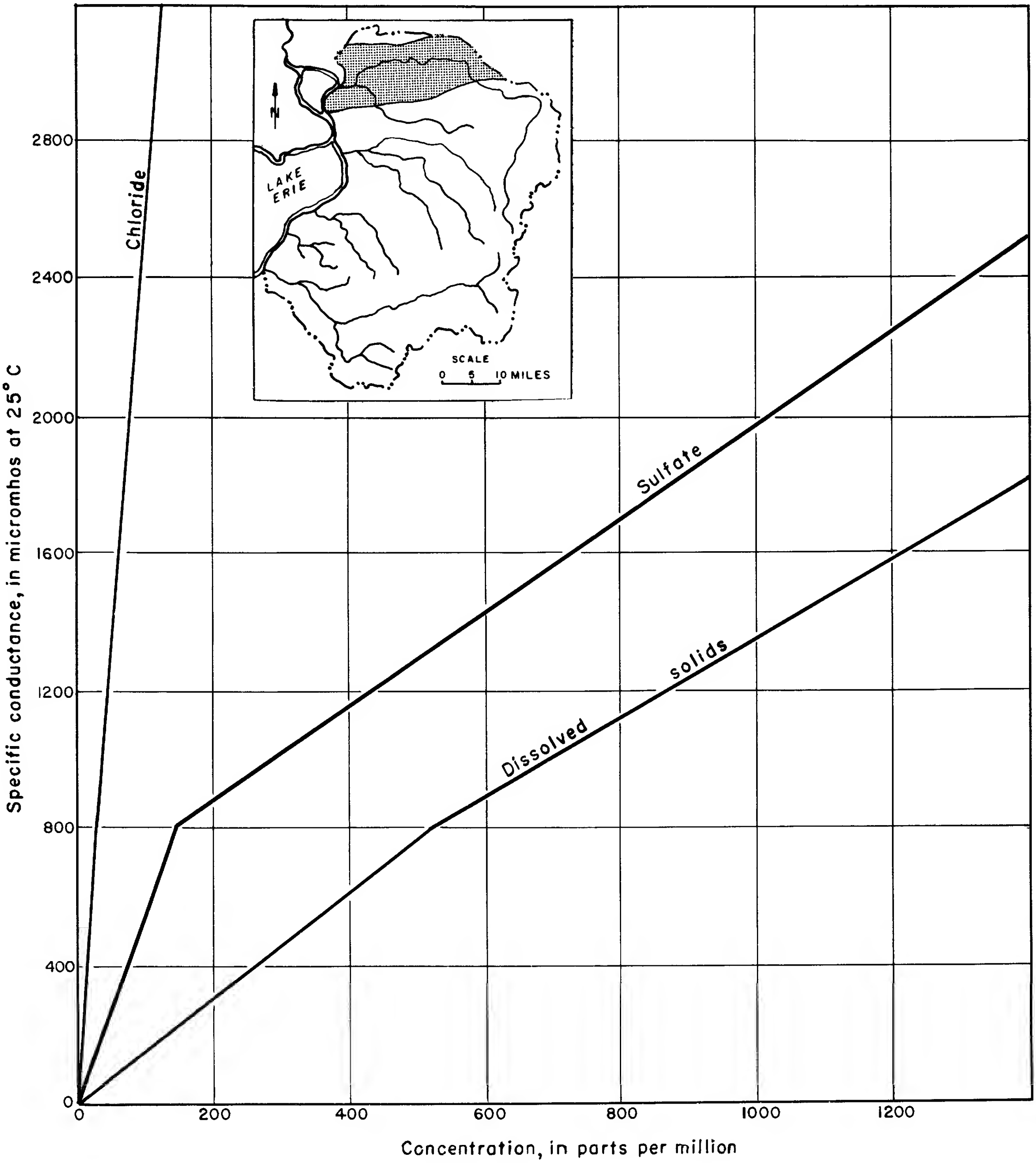



Figure 13.--Relation of specific conductance to selected chemical parameters of water in streams in the part of the Erie-Niagara basin where the Camillus Shale crops out.

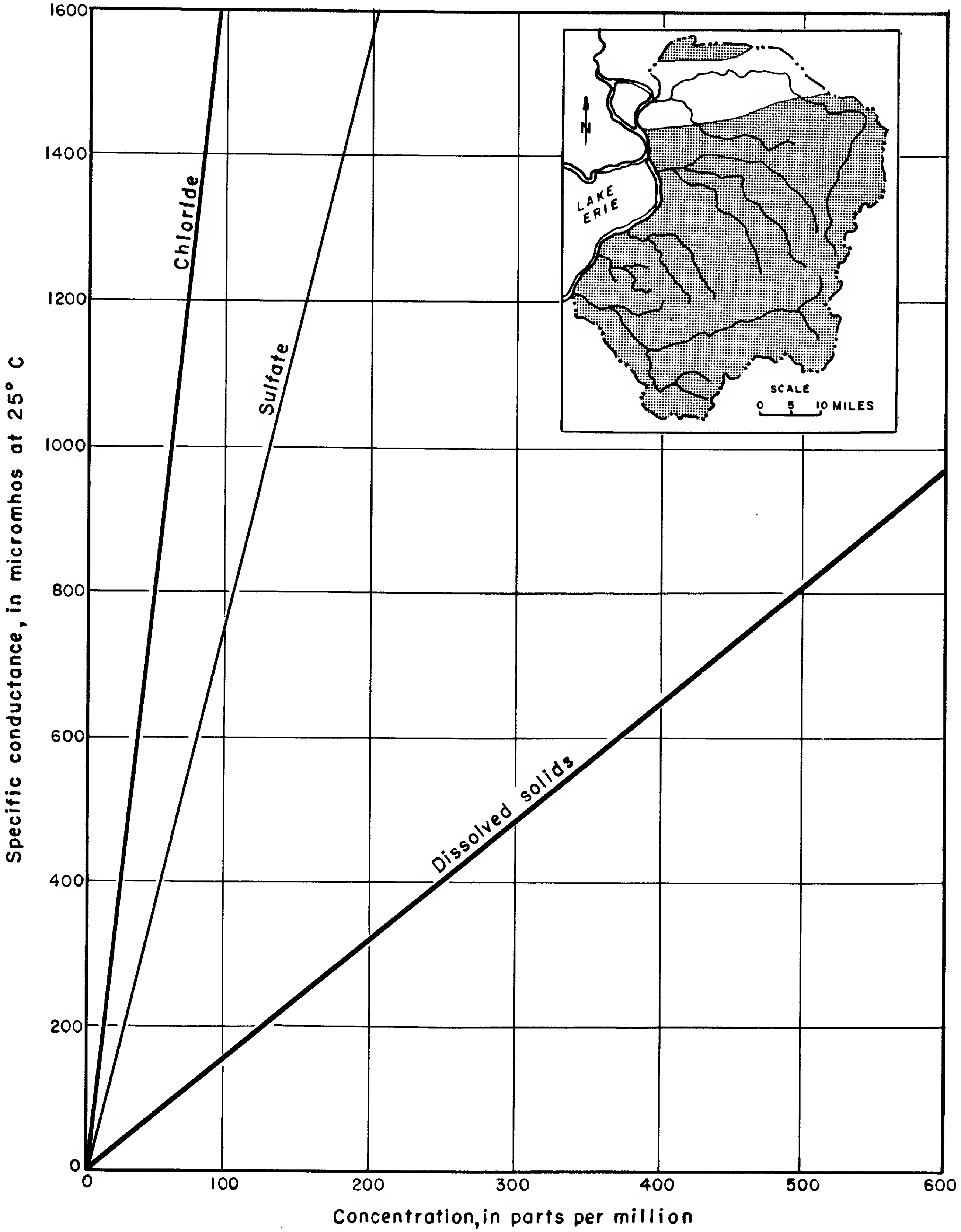



Figure 14.--Relation of specific conductance to selected chemical parameters of water in streams in the Erie-Niagara basin, except the area where Camillus Shale crops out.

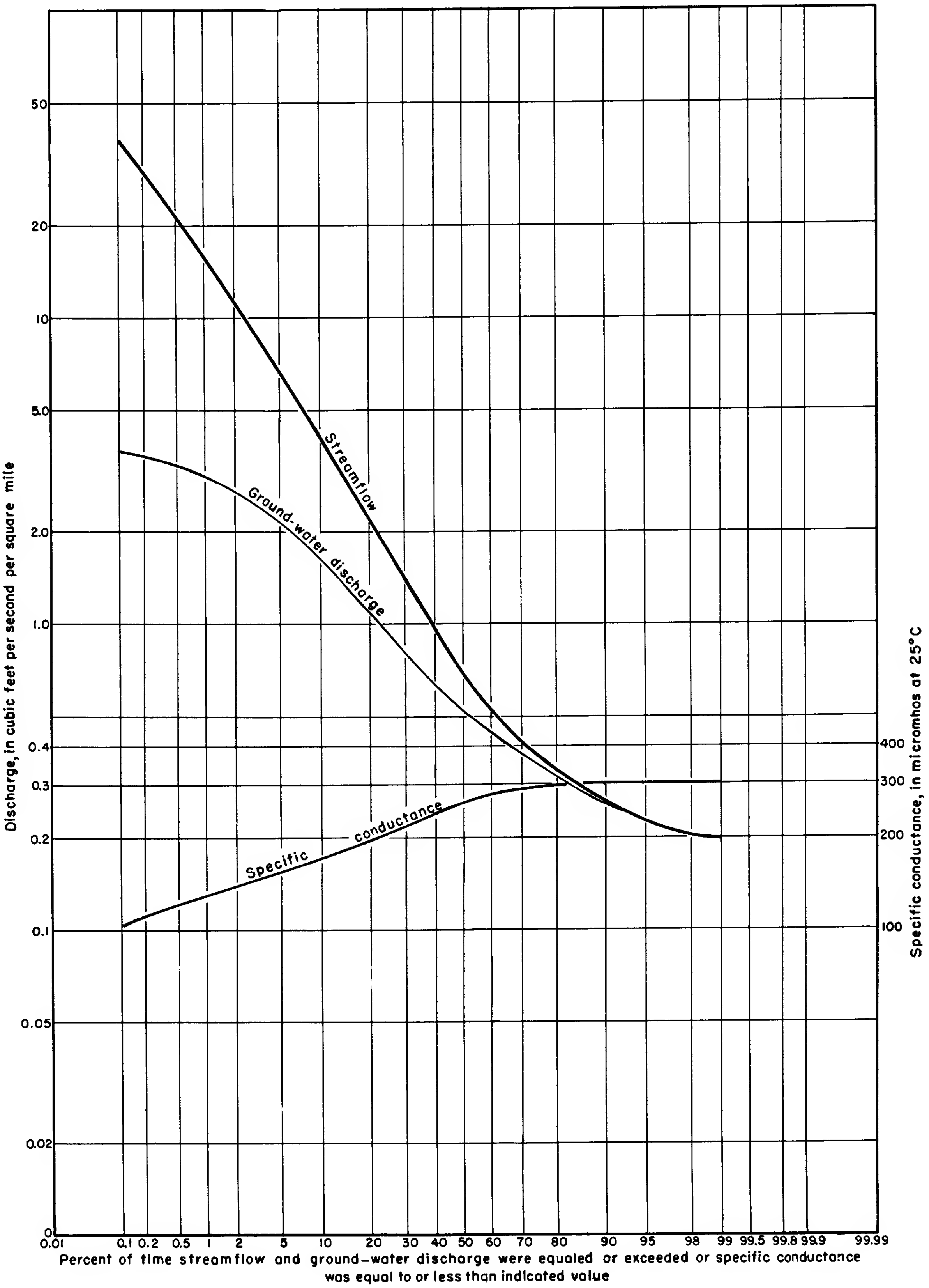



Figure 15.--Duration curves of streamflow, ground-water discharge, and specific conductance, Cattaraugus Creek near Arcade, adjusted to 1931-60 base period.

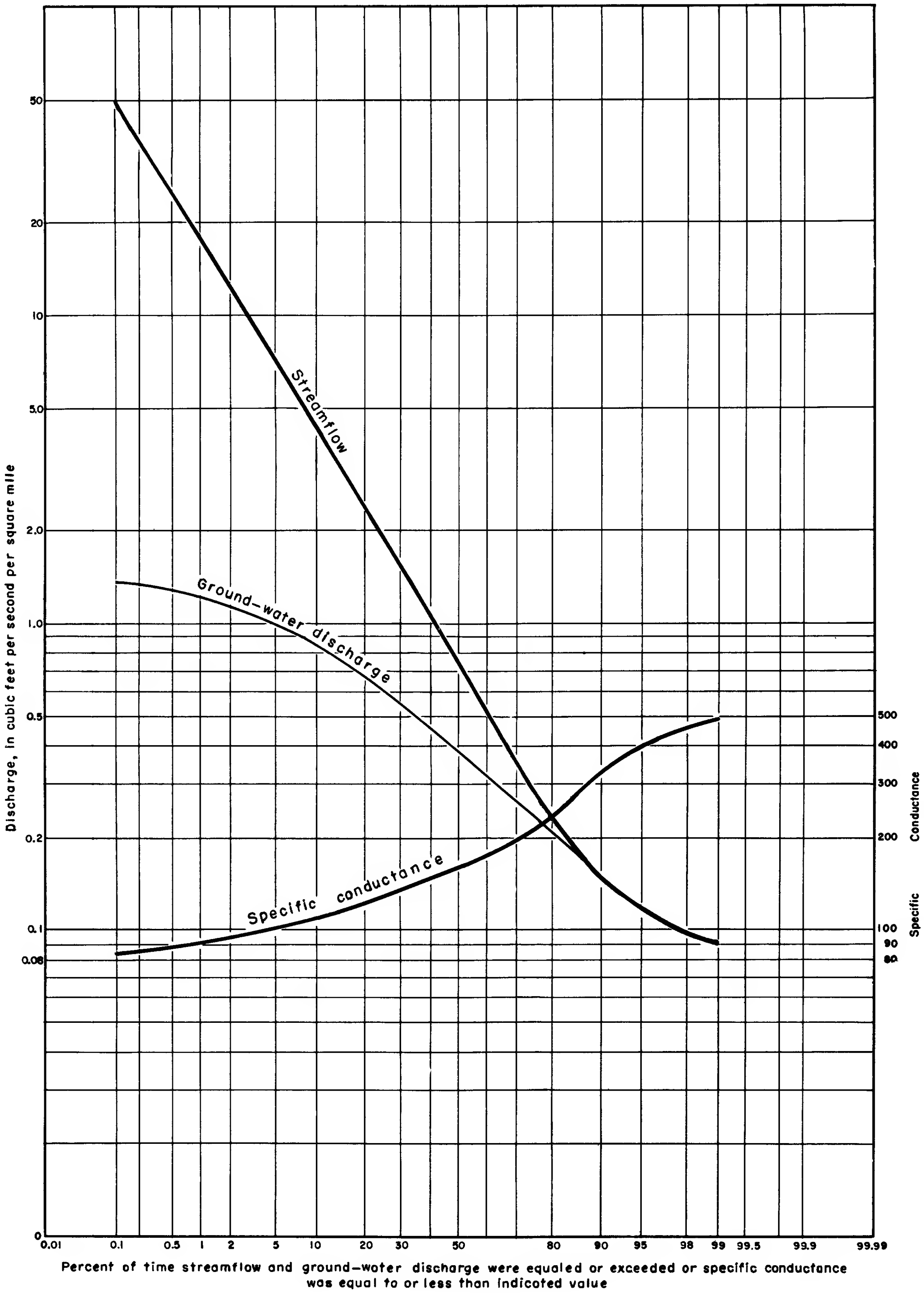



Figure 16.--Duration curves of streamflow, ground-water discharge, and specific conductance, Buttermilk Creek near Springville, adjusted to 1931-60 base period.

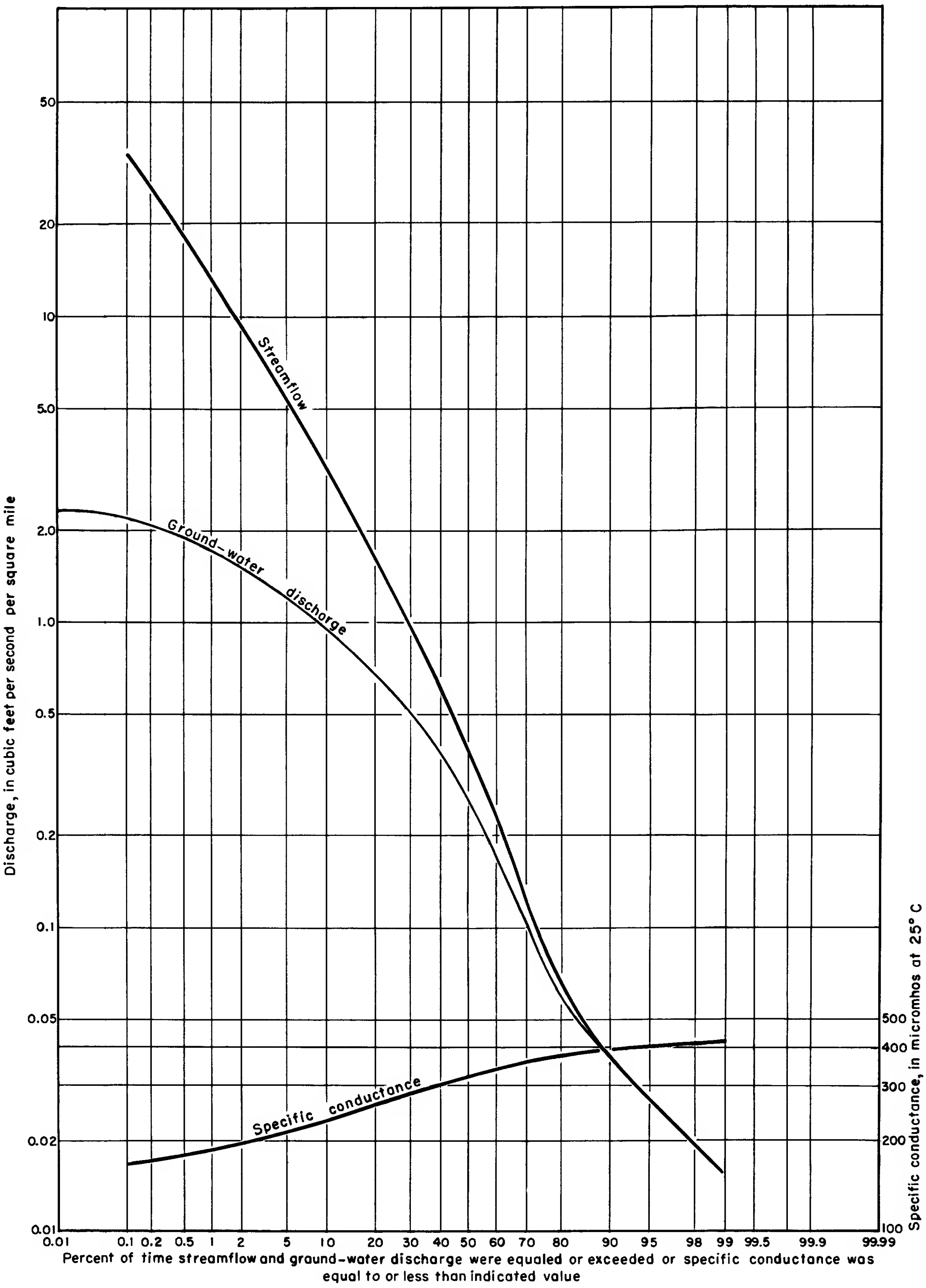



Figure 17.--Duration curves of streamflow, ground-water discharge, and specific conductance, Little Tonawanda Creek at Linden, adjusted to 1931-60 base period.

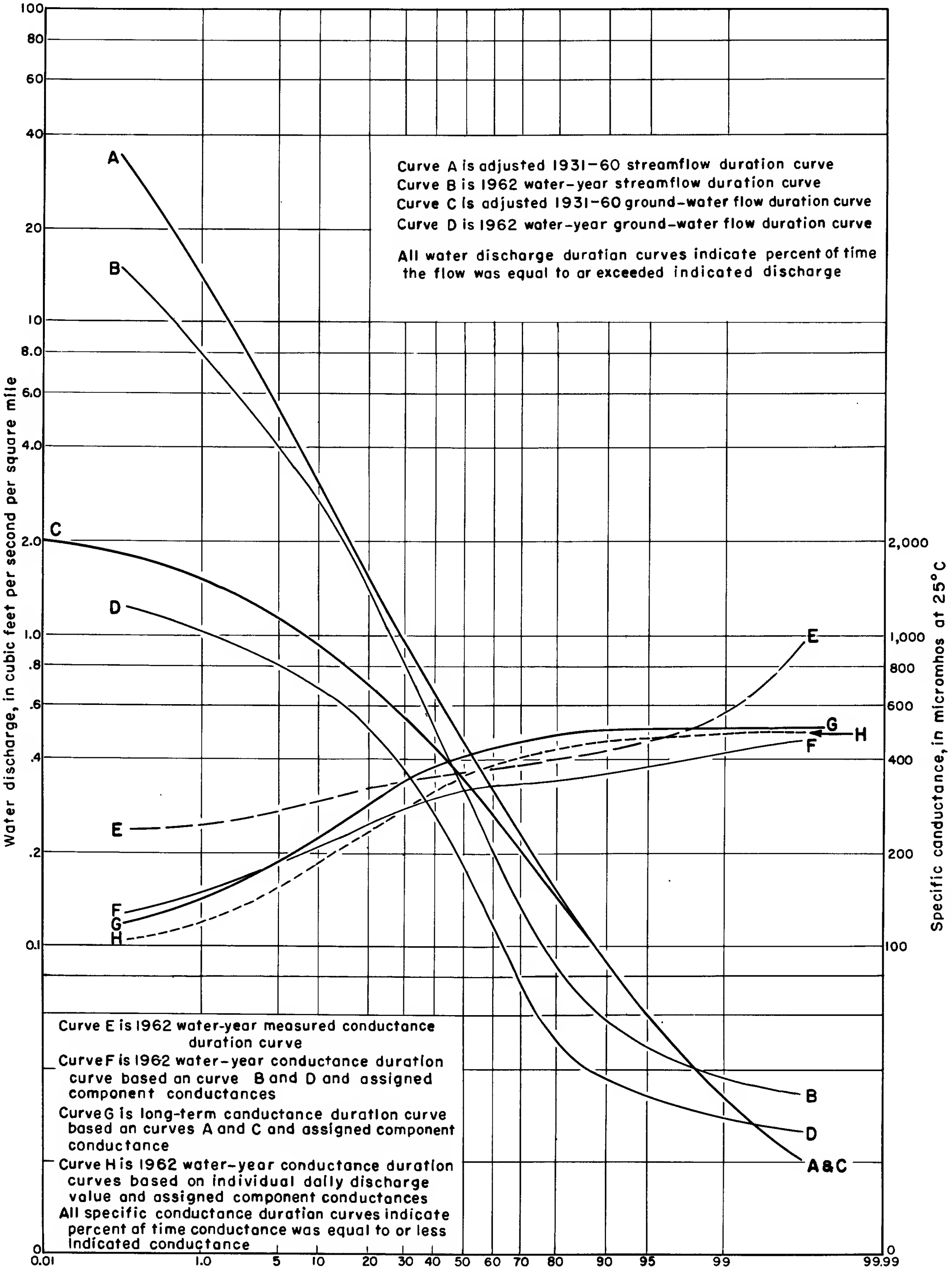



Figure 18.--Duration curves of streamflow, ground-water discharge, and specific conductance, Buffalo Creek at Gardenville.

ground-water discharge was estimated by the methods described in the ground-water report by LaSala (1968). The curves are discussed in those reports.

Note that the scale on the left side of each curve is expressed as flow or discharge in cubic feet per second per square mile of drainage area, and that the scale on the right side is specific conductance in micromhos. The specific conductance curves were prepared by computing the specific conductance of streamflow for several duration points, using the computed streamflow quality equation given on page 38 and the specific conductance values for overland flow and ground water given on page 40. Additional methods of computation were used to determine the other specific conductance duration curves in figure 18, as indicated. The fact that the duration lines in figure 18 of computed and measured conductance for like periods do not coincide with each other is probably an indication both of inaccurate or nonrepresentative data used in the computations (at least partly because of the large size of the area), and of the fact that equal percent-duration for ground water and streamflow are not necessarily concurrent.

# EFFECTS OF CHEMICAL CONSTITUENTS AND PROPERTIES UPON USE OF WATER

The chemical quality of water has a major effect upon the number of purposes for which the water may be used without treatment and the types of treatment required for some types of water use. Some uses require water with very low dissolved-solids content, whereas other uses, such as industrial cooling, can be met with water of high dissolved-solids content.

Much has been written on the subject of water-quality characteristics, tolerances, and treatment, including publications by the U.S. Public Health Service (1962), Betz Laboratories (1962), the California State Water Quality Control Board (McKee and Wolf, 1963), Hem (1959), Nordell (1961), and Powell (1954). Therefore, the only additional information presented here is in table 13 showing the source or cause and significance of dissolved mineral constituents and properties, along with representative ranges in chemical quality found in the Erie-Niagara basin.

The sanitary quality of a water also is important with respect to its suitability for an intended use. However, this subject is included in a report being prepared by the State Department of Health and therefore is not discussed in this report. The New York State Department of Health (1951, 1953, 1957, 1962) has published several reports within the past 15 years describing stream pollution in parts of the Erie-Niagara basin.

## Table 13.--Source or cause and significance of dissolved mineral constituents and properties of water as related to the Erie-Niagara basin

| Constituent or property | Source or cause | Significance | Concentration (ppm) values commonly found in streams in the Erie-Niagara basin (except at times of very low or very high flow): Entire area except lower Tonawanda Creek basin | Concentration (ppm) values commonly found in streams in the Erie-Niagara basin (except at times of very low or very high flow): Lower Tonawanda Creek basin | Federal drinking water standards 1/ (parts per million) |
|---|---|---|---|---|---|
| Alkyl benzene sulfonate (ABS) | Synthetic detergents in domestic, and industrial wastes. | Causes tastes and odors, and causes foam on streams and in treatment plants. Treatment somewhat difficult and generally incomplete. | 0.0-.4 | 0.0-.2 | 0.5 |
| Bicarbonate ($HCO_3$)<br>Carbonate ($CO_3$) | Action of carbon dioxide in water on carbonate cementing material and rocks, such as limestone and dolomite. | Produces alkalinity. On heating in the presence of calcium and magnesium can form scales in pipes and release corrosive carbon-dioxide gas. Aid in coagulation for the removal of suspended matter from water. | $HCO_3$ 91-180<br>$CO_3$ 0 | 150-230<br>0 | -- |
| Calcium (Ca),<br>Magnesium (Mg) | Dissolved from practically all soils and rocks, but especially from limestone, dolomite, and gypsum. | Causes most of the hardness and scale-forming properties of water; detergent consuming (see hardness). Water low in calcium and magnesium desired in electroplating, tanning, dyeing, and in textile manufacturing. Small amounts desirable to prevent corrosion. | Ca 32-58<br>Mg 6-12 | 58-160<br>11-22 | -- |
| Chloride (Cl) | Dissolved from rocks and soils. Present in sewage and industrial wastes. | Some people can detect salty taste in concentrations exceeding 100 ppm. Large quantities increases the corrosiveness of water. Present available treatment methods not generally economical for most uses. | 6-22 | 19-71 | 250 |
| Color | Decaying vegetation; peat, leaves, roots and other organic substances, industrial wastes and sewage and certain minerals. | Water for domestic and some industrial uses should be free from perceptible color. Color in water is objectionable in food and beverage processing and many manufacturing processes. | 3-9 | 6-26 | -- |
| Dissolved solids (residue on evaporation) | Chiefly mineral constituents dissolved from rocks and soils. Includes some water of crystallization. | Waters containing more than 1,000 ppm of dissolved solids are unsuitable for many purposes. | 140-240 | 260-720 | 500 |
| Fluoride (F) | Dissolved in small to minute quantities from most rocks and soils. Added to many waters by fluoridation of public supplies. | Fluoride concentrations between 0.8 and 1.5 ppm accepted as range for beneficial effect on the structure and resistance to decay of children's teeth in study area as based on the average annual daily maximum temperature of 56.3°F at Buffalo (Johnson, 1960, p. 11). Fluoride in excess of 6.0 ppm causes pronounced mottling and disfiguration of teeth. | 0.0-.2 | 0.2-.4 | -- |
| Hardness as $CaCO_3$ | In most waters nearly all hardness due to calcium and magnesium. | Consumes soap and synthetic detergents. Although less of a factor with synthetic detergents than with soap, it is still economical to soften hard waters (Aultman, 1958). | 100-190 | 190-490 | -- |
| Hydrogen ion, concentration (pH) | Hydrogen ion concentration. | A pH of 7.0 indicates neutrality of a solution. Values higher than 7.0 denote increased alkalinity; values lower than 7.0 indicate increased acidity. Corrosiveness of water generally increased with decreasing pH, but excessively alkaline waters may also attack metals. | 7.3-8.1 | 7.2-8.0 | -- |

1/ U.S. Public Health Service (1962).

Table 13.--Source or cause and significance of dissolved mineral constituents and properties of water as related to the Erie-Niagara basin (Continued)

| Constituent or property | Source or cause | Significance | Concentration (ppm) values commonly found in streams in the Erie-Niagara basin (except at times of very low or very high flow) | | Federal drinking water standards 1/ (parts per million) |
|---|---|---|---|---|---|
| | | | Entire area except lower Tonawanda Creek basin | Lower Tonawanda Creek basin | |
| Iron (Fe) | Dissolved from practically all rocks and soils. Found in some industrial wastes. Can be corroded from iron pipes, pumps and other equipment. | More than 0.1 ppm often precipitates on exposure to air, causing turbidity, staining and tastes and colors which are objectionable in food, beverage, textile processes and ice manufacture as well as the cause of problems in domestic use such as staining plumbing fixtures and laundry. | 0.03-.19 | 0.05-.19 | 0.3 |
| Manganese (Mn) | Dissolved from some rocks, soils, and lake bottom sediments. Sources associated with those of iron. | Same objectionable features as iron. Causes dark brown or black stains. Manganese removal associated with that of iron but more difficult and generally less complete. | 0.00-.03 | 0.01-.17 | .05 |
| Nitrate ($NO_3$) | Decaying organic matter, sewage, fertilizers and nitrates in soils. | Small amounts of nitrate help reduce cracking of high-pressure boiler steel. It encourages growth of algae and other organisms which produce undesirable taste and odors. Concentrations in excess of 45 ppm limit are suspected as cause of methemoglobinemia in infants. | 0.4-4.6 | 0.6-3.5 | 45 |
| Silica ($SiO_2$) | Dissolved from practically all rocks and soils. | Together with calcium and magnesium, silica forms a low-heat conducting hard glassy scale in boilers and turbines. Silica inhibits deterioration of zeolite-type water softeners and corrosion of iron pipes by soft water. | 1-6 | 1-7 | -- |
| Sodium (Na), Potassium (K) | Dissolved from practically all rocks and soils. Found in industrial wastes and sewage. | More than 50 ppm sodium and potassium in the presence of suspended matter causes foam in boilers which accelerates scale formation and corrosion. More than 65 ppm of sodium can cause problems in ice manufacture. (Durfor and Becker, 1964a, p. 17) | Na 3-12<br>K 1-3 | 9-30<br>2-4 | -- |
| Specific conductance | Mineral content of the water. | Guide to mineral content. It is a measure of the capacity of the water to conduct a current of electricity, and varies with the concentration and degree of ionization of the different minerals in solution. | 230-420 | 420-1,000 | -- |
| Sulfate ($SO_4$) | Dissolved from rocks and soils containing gypsum, sulfides, and other sulfur compounds. May be derived from industrial wastes, both liquid and atmospheric. | Sulfate in water containing calcium forms hard scale in steam boilers. In large amounts, sulfate in combination with other ions gives bitter taste to water. Some calcium sulfate is considered beneficial in brewing processes. | 22-55 | 40-350 | 250 |
| Turbidity | Suspended and colloidal matter. Sources can be soil erosion, industrial wastes, micro-organisms. | Turbid water aesthetically objectionable. Also, objectionable in many industrial processes; generally removed by sedimentation, clarification or filtration. | 0.0-.7 | 0.2-.7 | -- |

1/ U.S. Public Health Service (1962).

# CONCLUSIONS

The natural chemical quality of water in streams in most of the Erie-Niagara basin is good, and except for water in the lower Tonawanda Creek basin, little or no chemical quality treatment is needed for public water supply. Because of pollution, however, the sanitary quality and chemical quality of some streams is poor, especially in the immediate Buffalo area and in the downstream parts of several of the larger streams.

In much of the region, the dissolved-solids content of streams is between 140 and 240 ppm most of the time. The water is generally "hard," but the hardness of water in most streams is usually less than 200 ppm (expressed as $CaCO_3$). The iron content is less than 0.2 ppm throughout the area most of the time, and the hydrogen-ion concentration (pH) is usually between 7.0 and 8.0. Chloride concentrations are generally less than 20 ppm (except in the northern part of the area), and concentrations of nitrate seldom exceed 5 ppm in most of the region.

Although there are many local variations in chemical quality, especially at times of low streamflow, the only large part of the region with problems related to natural water quality is the lower Tonawanda Creek basin, from Batavia to the Niagara River, including Ellicott Creek. Most of this problem area is underlain by the Camillus Shale, from which calcium, sulfate, and other constituents are readily dissolved. Water in streams of that area often contains between 300 and 700 ppm (or more) of dissolved solids, 100 to more than 300 ppm of sulfate, 20 to 70 ppm (or more) of chloride, and usually has a hardness of between 200 and 500 ppm.

Ground water is the principal source of the dissolved minerals in the streams, especially during periods of low and moderate streamflow. The chemical quality of this ground water is a result of the presence of relatively soluble minerals in the various types of bedrock -- shale, sandstone, limestone, and dolomite -- which underlie the region beneath glacial deposits of clay, sand, and gravel. However, at times of heavy precipitation or snowmelt, the dissolved-mineral content in streams is more dilute, inasmuch as streamflow consists predominantly of water from overland flow, which in turn is largely the water precipitated on the area as rain or snow.

Regionwide the average chemical content of precipitation, based on records for the greater part of 1 year, included about 5 ppm of calcium, 10 ppm of sulfate, 0.1 ppm of chloride, and 35 ppm of dissolved solids. However, substantially higher concentrations sometimes occur, principally in the northern part of the area; and the limited sampling pointed to snow having a higher mineral content than rain. The source of much of this dissolved mineral matter found in precipitation is believed to be the burned or partly burned residues released to the air by industries in the Buffalo area, and to a lesser extent by industries to the west of the region, near other parts of the Great Lakes.

The types of data contained in this report make it possible to compute daily values (within an accuracy of about 5 to 20 percent) of the chemical characteristics for a given flow of a stream, if the stream represents a homogeneous hydrologic environment with an area of less than 50 square miles, if a continuous record of streamflow is maintained and if the effects of pollution are minimal. The chief inadequacies of data for this type of computation for small streams concern high flows of the streams.

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# APPENDIX A
# NUMBERING SYSTEM FOR SAMPLING SITES

Sampling sites referred to in this report are numbered under several systems according to the types of samples. All stream-sampling sites are numbered according to the system adapted by the New York State Health Department from a system introduced by the New York State Conservation Department. In this system, tributaries to the Great Lakes are numbered in a clockwise direction, and their tributaries are numbered consecutively, progressing upstream from the mouth. For example, Cattaraugus Creek, the 23d tributary to Lake Erie is numbered E23, whereas Elton Creek, the 48th upstream tributary to Cattaraugus Creek, is numbered E23-48. Specific sites are designated by adding to this "water index number," in parentheses, the "mileage index number," which is the distance in miles upstream from the mouth of the particular stream. Hence, the site on Elton Creek at The Forks, 0.6 mile upstream from the mouth of Elton Creek is numbered E23-48(0.6). The Niagara River is the 158th tributary of Lake Ontario, hence it is numbered O158. Index maps showing "water index numbers" for most streams listed in the tables of this report are included in the reports of the New York State Department of Health (1951, 1953, and 1957).

Sampling sites on the New York State Barge Canal system are numbered under the system used by the Waterway Operation and Maintenance Subdivision of the New York State Department of Public Works, whereby each bridge crossing the Canal is numbered and the distance in miles along the Canal west of the bridge is put in parentheses after the bridge number. Hence, the site Barge (Erie) Canal at Lock 35, at Lockport, is numbered E230(0.8) and is 0.8 mile west of bridge 230.

In addition to the State system, many of the stream-sampling sites referred to in this report are also numbered in the U.S. Geological Survey national stream-station-numbering system. In this system numbers are assigned in a downstream order, but intervals are left in the numbers to allow for later additions. The number for Elton Creek at the Forks is 2134.2. Table 24 was prepared as a cross-reference of the State sampling-point mileage index number and the latitude and longitude of each of the sampling sites; also included in this table are the U.S. Geological Survey station numbers, where used.

The numbering of snow and overland-flow sampling sites used in this report is based on latitude and longitude. Each number consists of three parts: first, the last digit of the degree of latitude, and the two digits for the minutes of latitude of the southeast corner of the 1-minute quadrangle in which the sampling site occurs; second, the similar digits of longitude; and third, the letter P for the snow sites or letter A, B, C, or D for the overland-flow sites, the choice depending on the order of previous miscellaneous observations within the quadrangle.

# APPENDIX B
# BASIC DATA TABLES

Table 14.--Chemical analyses of precipitation

Location: At Arcade  Latitude 42°32'  Longitude 78°25'

Point of collection: At 96 Liberty St.

| Date of collection | Measured amount (inches of water) | Calcium (Ca) (ppm) | Sulfate ($SO_4$) (ppm) | Chloride (Cl) (ppm) | Specific conductance (micromhos at 25°C) | pH |
|---|---|---|---|---|---|---|
| 3- 8-63 | 0.17 | -- | 5.5 | 0.0 | 37 | 6.4 |
| 3-17-63 | .53 | -- | 13 | .0 | 66 | 6.5 |
| 3-26-63 | .21 | -- | 11 | .1 | 61 | 6.7 |
| 4- 4-63 | .75 | -- | 3.5 | .0 | 28 | 6.6 |
| 4-17-63 | .27 | -- | 13 | .1 | 65 | 6.6 |
| 4-19-63 | 1.30 | -- | 6.1 | .0 | 35 | 6.3 |
| 4-23-63 | .50 | -- | 6.9 | .0 | 33 | 6.4 |
| 7-20-63 | 1.28 | 4.2 | 17 | .0 | 26 | 6.4 |
| 8- 7-63 | .91 | 3.1 | 5.0 | .0 | 15 | 6.2 |
| 8-13-63 | .51 | 5.6 | 7.1 | .0 | 32 | 6.2 |
| 8-14-63 | -- | 3.2 | 4.5 | .0 | 15 | 6.4 |
| Maximum observed | | 5.6 | 17 | 0.1 | 66 | 6.7 |
| Minimum observed | | 3.1 | 3.5 | .0 | 15 | 6.2 |
| Median | | 3.7 | 6.9 | .0 | 33 | 6.4 |

Table 14.--Chemical analyses of precipitation (Continued)

Location: At Gowanda Latitude 42°29' Longitude 78°56'

Point of collection: At Gowanda State Hospital

| Date of collection | Measured amount (inches of water) | Calcium (Ca) (ppm) | Sulfate ($SO_4$) (ppm) | Chloride (Cl) (ppm) | Specific conductance (micromhos at 25°C) | pH |
|---|---|---|---|---|---|---|
| 3- 2-63 | 0.31 | -- | 16 | 5.9 | 129 | 7.1 |
| 3- 6-63 | .23 | -- | 41 | -- | 170 | 6.0 |
| 3-13-63 | .41 | -- | 17 | .0 | 109 | 6.1 |
| 3-20-63 | .35 | -- | 18 | .6 | 65 | 6.0 |
| 4- 4-63 | .65 | -- | 11 | .0 | 56 | 5.9 |
| 4-23-63 | .42 | -- | 99 | .0 | 283 | 6.0 |
| 6-12-63 | -- | -- | 32 | .0 | 114 | 6.3 |
| 6-29-63 | .50 | 12 | 24 | .0 | 109 | 6.3 |
| 7-20-63 | 1.70 | 6.5 | 17 | .0 | 72 | 6.3 |
| 7-30-63 | .56 | 4.7 | 20 | .0 | 30 | 6.2 |
| 8- 8-63 | .98 | 7.7 | 20 | .0 | 61 | 6.0 |
| 8-13-63 | .55 | 5.6 | 17 | .0 | 50 | 5.9 |
| 8-14-63 | 1.48 | 2.6 | 8.0 | .0 | 16 | 6.3 |
| 9- 4-63 | .45 | 6.4 | 14 | .0 | 40 | 6.2 |
| 9-13-63 | .50 | 6.5 | 13 | .0 | 51 | 6.1 |
| Maximum observed | | 12 | 99 | 5.9 | 283 | 7.1 |
| Minimum observed | | 2.6 | 8.0 | .0 | 16 | 5.9 |
| Median | | 6.4 | 17 | .0 | 65 | 6.1 |

Table 14.--Chemical analyses of precipitation (Continued)

Location: At Colden  Latitude 42°40'  Longitude 78°41'

Point of collection: On route 240, 1 mile north of Colden

| Date of collection | Measured amount (inches of water) | Calcium (Ca) (ppm) | Sulfate ($SO_4$) (ppm) | Chloride (Cl) (ppm) | Specific conductance (micromhos at 25°C) | pH |
|---|---|---|---|---|---|---|
| 3-12-63 | -- | -- | 13 | 0.1 | 52 | 5.9 |
| 3-13-63 | -- | -- | 14 | .1 | 60 | 6.2 |
| 3-30-63 | -- | -- | 16 | .0 | 64 | 6.1 |
| 4- 4-63 | -- | -- | 7.9 | .0 | 41 | 6.2 |
| 4-17-63 | -- | -- | 4.3 | .0 | 29 | 6.4 |
| 4-19-63 | -- | -- | 8.1 | .0 | 45 | 6.5 |
| 4-20-63 | -- | -- | 3.5 | .0 | 22 | 6.4 |
| 4-23-63 | -- | -- | 7.5 | .0 | 32 | 6.2 |
| 4-30-63 | -- | -- | 5.7 | .0 | 32 | 6.4 |
| 5- 9-63 | -- | -- | 16 | .0 | 68 | 6.6 |
| 5-20-63 | -- | -- | 4.9 | .0 | 32 | 6.6 |
| 5-29-63 | -- | -- | 4.3 | .0 | 24 | 6.4 |
| 6-10-63 | -- | -- | 4.3 | .0 | 34 | 6.2 |
| 7- 2-63 | -- | 26 | 39 | .0 | 202 | 7.0 |
| 7-19-63 | -- | 4.2 | 10 | .0 | 30 | 6.0 |
| 7-29-63 | -- | 3.2 | 8.7 | .0 | 20 | 6.0 |
| 8- 7-63 | -- | 4.0 | 17 | .0 | 44 | 6.4 |
| 8-13-63 | -- | 3.8 | 18 | .0 | 30 | 6.4 |
| 8-14-63 | -- | 2.8 | 5.0 | 1.1 | 24 | 6.8 |
| 9-20-63 | -- | 4.1 | 9.5 | .0 | 29 | 6.3 |
| Maximum observed | | 26 | 39 | 1.1 | 202 | 7.0 |
| Minimum observed | | 2.8 | 3.5 | .0 | 20 | 5.9 |
| Median | | 4.1 | 9.1 | .0 | 32 | 6.2 |

Table 14.--Chemical analyses of precipitation (Continued)

Location: At Emery Park, South Wales — Latitude 42°43' — Longitude 78°36'

Point of collection: At 2084 Emery Rd.

| Date of collection | Measured amount (inches of water) | Calcium (Ca) (ppm) | Sulfate ($SO_4$) (ppm) | Chloride (Cl) (ppm) | Specific conductance (micromhos at 25°C) | pH |
|---|---|---|---|---|---|---|
| 3- 2-63 | 0.25 | -- | 7.1 | 0.0 | 36 | 5.4 |
| 4- 4-63 | .91 | -- | 13 | .0 | 56 | 6.5 |
| 4-24-63 | .28 | -- | 24 | 1.0 | 72 | 6.5 |
| 5- 1-63 | .30 | -- | 14 | .0 | 54 | 6.6 |
| 5- 9-63 | .62 | -- | 15 | .0 | 64 | 6.6 |
| 5-10-63 | .28 | -- | 15 | .0 | 63 | 6.6 |
| 5-20-63 | .40 | -- | 15 | .0 | 59 | 6.7 |
| 6-10-63 | 1.75 | -- | 7.1 | .0 | 37 | 6.5 |
| 7-15-63 | .52 | 8.9 | 19 | .0 | 75 | 6.6 |
| 7-19-63 | 1.20 | 4.4 | 14 | .0 | 44 | 6.4 |
| 7-29-63 | .70 | 4.0 | 12 | .0 | 30 | 6.5 |
| 8- 8-63 | 1.55 | 8.1 | 11 | .0 | 29 | 6.5 |
| 8-13-63 | .65 | 3.0 | 10 | .0 | 38 | 6.5 |
| 8-14-63 | 1.60 | 1.6 | 7.1 | .0 | 16 | 6.7 |
| 9-13-63 | .74 | 3.2 | 7.1 | .0 | 32 | 6.4 |
| 9-20-63 | .60 | 3.9 | 8.9 | .0 | 39 | 6.7 |
| Maximum observed | | 8.9 | 24 | 1.0 | 75 | 6.7 |
| Minimum observed | | 1.6 | 7.1 | .0 | 16 | 5.4 |
| Median | | 4.0 | 12 | .0 | 42 | 6.5 |

Table 14.--Chemical analyses of precipitation (Continued)

Location: At Linden    Latitude 42°53'    Longitude 78°10'

Point of collection: On Linden Rd. at Linden

| Date of collection | Measured amount (inches of water) [a] | Calcium (Ca) (ppm) | Sulfate ($SO_4$) (ppm) | Chloride (Cl) (ppm) | Specific conductance (micromhos at 25°C) | pH |
|---|---|---|---|---|---|---|
| 3-13-63 | -- | -- | 15 | 0.1 | 70 | 6.5 |
| 3-26-63 | 0.35 | -- | 54 | .4 | 214 | 6.7 |
| 4- 2-63 | -- | -- | 18 | .1 | 77 | 6.6 |
| 4- 4-63 | 1.10 | -- | 10 | .1 | 89 | 6.9 |
| 4-18-63 | .45 | -- | 40 | 2.8 | 200 | 7.0 |
| 4-19-63 | .50 | -- | 9.5 | .2 | 87 | 7.0 |
| 4-20-63 | .90 | -- | 10 | .3 | 75 | 7.0 |
| 5- 9-63 | 1.10 | -- | 4.7 | .7 | 97 | 6.4 |
| 5-29-63 | .50 | -- | 14 | .9 | 112 | 6.8 |
| 7-19-63 | -- | 3.2 | 8.9 | .0 | 39 | 6.6 |
| 7-29-63 | -- | 4.4 | 7.1 | .0 | 57 | 6.9 |
| 8- 6-63 | .35 | 4.8 | 10 | .0 | 63 | 6.8 |
| 8-13-63 | -- | 3.3 | 8.0 | .0 | 42 | 6.6 |
| 8-29-63 | .50 | 6.0 | 13 | .0 | 65 | 6.8 |
| 9-20-63 | -- | 7.2 | 9.1 | .0 | 59 | 6.7 |
| Maximum observed | | 7.2 | 54 | 2.8 | 214 | 7.0 |
| Minimum observed | | 3.2 | 4.7 | .0 | 39 | 6.4 |
| Median | | 4.8 | 10 | .1 | 75 | 6.8 |

a/ Amount reported for collection period does not necessarily correspond with data published by the Weather Bureau.

Table 14.--Chemical analyses of precipitation (Continued)

Location: At Cheektowaga Latitude 42°56' Longitude 78°25'

Point of collection: Buffalo International Airport

| Date of collection | Measured amount (inches of water) a/ | Calcium (Ca) (ppm) | Sulfate ($SO_4$) (ppm) | Chloride (Cl) (ppm) | Specific conductance (micromhos at 25°C) | pH |
|---|---|---|---|---|---|---|
| 4-17-63 | 0.24 | -- | 30 | 1.2 | 138 | 6.6 |
| 4-19-63 b/ | .31 | -- | 11 | .3 | 52 | 6.5 |
| 4-19-63 c/ | .60 | -- | 9.5 | .1 | 39 | 6.0 |
| 5- 1-63 | .40 | -- | 12 | .2 | 58 | 6.8 |
| 5- 8-63 | .40 | -- | 11 | .9 | 56 | 6.7 |
| 5-20-63 | -- | -- | 10 | -- | 50 | 6.8 |
| 7- 2-63 | 1.00 | 9.6 | 20 | .0 | 88 | 6.5 |
| 7-19-63 | .83 | 6.4 | 14 | .0 | 66 | 6.3 |
| 7-29-63 | -- | 3.7 | 16 | .0 | 40 | 5.9 |
| 8-13-63 | -- | 3.0 | 12 | .0 | 29 | 5.8 |
| 8-30-63 | -- | 5.5 | 13 | .0 | 51 | 5.9 |
| 9-12-63 | -- | 10 | 13 | .0 | 67 | 6.5 |
| Maximum observed | | 10 | 30 | 1.2 | 138 | 6.8 |
| Minimum observed | | 3.0 | 9.5 | .0 | 29 | 5.8 |
| Median | | 6.0 | 12 | .0 | 54 | 6.5 |

a/ Amount reported for collection period does not necessarily correspond with data published by the Weather Bureau.
b/ Collected at 1145 hrs.
c/ Collected at 2000 hrs.

Table 14.--Chemical analyses of precipitation (Continued)

Location: At Batavia Latitude 43°00' Longitude 78°11'

Point of collection: At County Highway Dept. on Mill St.

| Date of collection | Measured amount (inches of water) | Calcium (Ca) (ppm) | Sulfate ($SO_4$) (ppm) | Chloride (Cl) (ppm) | Specific conductance (micromhos at 25°C) | pH |
|---|---|---|---|---|---|---|
| 3-13-63 | 0.52 | -- | 28 | 4.9 | 130 | 6.8 |
| 3-20-63 | .33 | -- | 26 | 1.5 | 116 | 6.6 |
| 4- 4-63 | .73 | -- | 4.9 | 1.1 | 38 | 6.9 |
| 4-19-63 | .84 | -- | 16 | 1.0 | 63 | 6.4 |
| 4-20-63 | .44 | -- | 8.1 | .0 | 40 | 6.7 |
| 4-23-63 | .31 | -- | 25 | .2 | 89 | 6.3 |
| 5- 1-63 | -- | -- | 25 | 6.7 | 110 | 6.3 |
| 5- 9-63 | .76 | -- | 15 | 1.1 | 68 | 6.6 |
| 5-10-63 | .70 | -- | 10 | .0 | 40 | 6.5 |
| 5-20-63 | .25 | -- | 17 | 1.8 | 63 | 6.4 |
| 7- 2-63 | 1.28 | 6.9 | 10 | .0 | 71 | 6.0 |
| 7-19-63 | 1.48 | 5.8 | 30 | .0 | 42 | 5.9 |
| 7-29-63 | .57 | 6.9 | 14 | .0 | 61 | 6.0 |
| 8- 1-63 | .91 | 5.6 | 12 | .0 | 45 | 6.0 |
| 8-13-63 | 1.35 | 5.4 | 12 | .0 | 41 | 6.1 |
| 9-13-63 | -- | 8.5 | 17 | .0 | 68 | 6.0 |
| Maximum observed | | 8.5 | 30 | 6.7 | 130 | 6.9 |
| Minimum observed | | 5.4 | 4.9 | .0 | 38 | 5.9 |
| Median | | 5.7 | 16 | .1 | 63 | 6.4 |

# Table 15.--Chemical analyses of snow

Sampling site number.--See appendix A.

| Sampling site number | Location | Point of collection | Date of collection | Calcium (Ca) (ppm) | Magnesium (Mg) (ppm) | Sodium (Na) (ppm) | Sulfate ($SO_4$) (ppm) | Chloride (Cl) (ppm) | Hardness as $CaCO_3$ (ppm) | Dissolved solids at 180°C (ppm) | Specific conductance (micromhos at 25°C) | pH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 221-841-P | At Plato | On Plato Rd., 500 ft south of bridge over East Otto 1.0 mile west of Plato. | Feb. 17, 1964 | -- | -- | -- | -- | -- | -- | -- | 36 | -- |
| 222-847-P | Near Otto | At intersection of East Otto, Thompson and Scotts Corners Rds., 2 miles northeast of Otto. | Feb. 17, 1964 | 6.5 | -- | -- | 8.6 | 4.1 | -- | -- | 61 | -- |
| 224-836-P | At West Valley | On Rt. 219, 200 ft north of Fenton Hill Rd. | Feb. 17, 1964 | -- | -- | -- | -- | -- | -- | -- | 70 | -- |
| 225-856-P | Near Gowanda | On Rt. 62, at intersection with Van Etten Rd., 2 miles south of Gowanda. | Feb. 17, 1964 | -- | -- | -- | -- | -- | -- | -- | 40 | -- |
| 226-841-P | Near Springville | At intersection of Rt. 219 and Connoisarauley Rd. | Feb. 17, 1964 | 2.4 | -- | -- | 3.8 | 1.4 | -- | -- | 25 | 4.8 |
| 227-853-P | Near Gowanda | On Gowanda-Zoar Rd., 2 miles east of Gowanda. | Feb. 17, 1964 | 1.7 | -- | -- | 2.4 | 2.1 | -- | 34 | 70 | 3.50 |
| 229-822-P | At Sandusky | Between Rt. 98 and Clear Creek at southeast side of Sandusky. | Feb. 17, 1964 | -- | -- | -- | -- | -- | -- | -- | 87 | -- |
| 229-828-P | At Delevan | On Rt. 16 at north side of Delevan. | Feb. 17, 1964 | -- | -- | -- | -- | -- | -- | -- | 51 | -- |
| 229-850-P | At Collins Center | On Rt. 75 in Catholic Church parking lot. | Feb. 17, 1964 | -- | -- | -- | -- | -- | -- | -- | 78 | -- |
| 229-855-P | At Collins | At intersection of Rt. 62 and 39. | Feb. 17, 1964 | 1.0 | -- | -- | 4.2 | 3.8 | -- | -- | 60 | -- |
| 230-835-P | Near Springville | At intersection of Rt. 39 and Van Slyke Rd., halfway between Springville and Sardinia. | Feb. 17, 1964 | 4.6 | -- | -- | 5.8 | 3.9 | -- | -- | 57 | -- |
| 230-841-P | At Springville | At intersection of Rts. 219 and 39 west of Springville. | Feb. 17, 1964 | -- | -- | -- | -- | -- | -- | -- | 41 | -- |
| 232-825-P | At Arcade | At intersection of Rt. 98 and North St. at east side of Arcade. | Feb. 17, 1964 | -- | -- | -- | -- | -- | -- | -- | 69 | -- |
| 232-901-P | Near Iroquois | At intersection of Mile Level and Brant-Reservation Rds., and 500 ft west of Clear Creek. | Feb. 17, 1964 | -- | -- | -- | -- | -- | -- | -- | 32 | -- |
| 234-828-P | At Chaffee | On Allen Rd. at west side of Chaffee. | Feb. 17, 1964 | 2.0 | -- | -- | 3.8 | 1.2 | -- | -- | 29 | 4.30 |
| 234-834-P | Near Chaffee | On Allen Rd., halfway between Chaffee and East Concord. | Feb. 17, 1964 | 1.7 | -- | -- | 3.4 | 32 | -- | -- | 125 | 4.20 |
| 235-852-P | At Langford | At intersection of Rt. 249 and Jennings Rd., 0.5 mile west of Langford. | Feb. 18, 1964 | .9 | -- | -- | 2.6 | .7 | -- | -- | 13 | 3.90 |
| 235-905-P | At Farnham | On Lotus Point Rd., 0.2 mile west of Farnham. | Feb. 17, 1964 | -- | -- | -- | -- | -- | -- | -- | 33 | -- |
| 236-856-P | At North Collins | On Rt. 62, at Franklin Gulf Brook. | Feb. 18, 1964 | -- | -- | -- | -- | -- | -- | -- | 33 | -- |
| 237-820-P | At East Java | On Chaffee Rd., 1,500 ft east of Cattaraugus Creek. | Feb. 17, 1964 | 17 | -- | -- | 23 | 9.5 | -- | -- | 160 | -- |
| 239-833-P | At Holland | On Rt. 16, 0.5 mile north of Holland and 200 ft south of "twin brooks" crossing. | Feb. 18, 1964 | -- | -- | -- | -- | -- | -- | -- | 28 | -- |
| 239-902-P | At Evans Center | At intersection of Bennett and Farm Rds., 0.2 mile west of Evans Center. | Feb. 17, 1964 | 1.4 | -- | -- | 1.8 | 0 | -- | -- | 18 | 4.40 |
| 241-826-P | At Strykersville | On Rt. 78, at brook in Strykersville. | Feb. 18, 1964 | -- | -- | -- | -- | -- | -- | -- | 37 | -- |
| 241-852-P | At Eden Valley | On Webster Rd., 0.2 mile west of Rt. 62 and 0.5 mile north of Eden Valley. | Feb. 17, 1964 | 2.2 | -- | -- | 5.0 | 4.1 | -- | -- | 34 | 4.7 |
| 242-820-P | At North Java Station | At intersection of Rt. 98 and Almeter Rd. | Feb. 18, 1964 | -- | -- | -- | -- | -- | -- | -- | 24 | -- |

## Table 15.--Chemical analyses of snow (Continued)

| Sampling site number | Location | Point of collection | Date of collection | Calcium (Ca) (ppm) | Magnesium (Mg) (ppm) | Sodium (Na) (ppm) | Sulfate ($SO_4$) (ppm) | Chloride (Cl) (ppm) | Hardness as $CaCO_3$ (ppm) | Dissolved solids at 180°C (ppm) | Specific conductance (micromhos at 25°C) | pH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 244-835-P | At Blakely | At intersection of Blakely Corners Rd., and Rt. 16 at west side of Blakely. | Feb. 17, 1964 | -- | -- | -- | -- | -- | -- | -- | 439 | 3.40 |
| 244-849-P | At Hamburg | At Erie County fairgrounds on Rt. 62. | Feb. 17, 1964 | -- | -- | -- | -- | -- | -- | -- | 33 | -- |
| 246-818-P | Near Varysburg | On Schlenker Rd., 1.2 miles northeast of Varysburg. | Feb. 17, 1964 | 2.0 | -- | -- | 12 | 2.1 | -- | -- | 62 | 4.15 |
| 246-821-P | do. | At intersection of Rt. 20A and French Rd., 2 miles west of Varysburg. | Feb. 17, 1964 | -- | -- | -- | -- | -- | -- | -- | 229 | 3.80 |
| 246-829-P | Near Wales Center | On Rt. 20A, near Stony Bottom Creek, 2.2 miles east of Wales Center. | Feb. 17, 1964 | 9.6 | -- | -- | 222 | 44 | -- | 327 | 890 | 3.00 |
| 246-835-P | At East Aurora | On Rt. 20A at east side of East Aurora. | Feb. 17, 1964 | -- | -- | -- | -- | -- | -- | -- | 52 | -- |
| 246-842-P | Near Orchard Park | On Rt. 20A, 1.6 miles east of Orchard Park. | Feb. 17, 1964 | 2.0 | -- | -- | 7.8 | 3.1 | -- | -- | 24 | -- |
| 247-849-P | At Blasdell | On Lake Ave. east of Rt. 62. | Feb. 18, 1964 | 2.4 | -- | -- | 2.6 | 14 | -- | -- | 61 | -- |
| 248-833-P | At Porterville | At intersection of Rts. 358 and 422. | Feb. 17, 1964 | 14 | 5.1 | 1.3 | 21 | 62 | 56 | -- | 298 | 3.75 |
| | | | Jan. 14, 1965 | 2.3 | -- | -- | 3.6 | 4.7 | -- | -- | 40 | 6.2 |
| | | | Feb. 2 | 1.4 | -- | -- | 2.8 | 1.7 | -- | -- | 24 | 5.4 |
| 248-839-P | Near East Aurora | On Rt. 16, at former Proner Airport, 3 miles northwest of East Aurora. | Feb. 17, 1964 | 8.8 | 6.8 | 6.9 | 126 | 30 | 50 | -- | 540 | 3.30 |
| 250-817-P | At Attica | On Rt. 98, at Attica and Arcade RR crossing south of Attica. | Feb. 17, 1964 | 3.3 | -- | -- | 4.6 | 4.8 | -- | -- | 46 | -- |
| 251-814-P | Near Attica | On road to Vernal Corners, 2.5 miles east of Attica. | Feb. 17, 1964 | 8.6 | -- | -- | 18 | 8.4 | -- | -- | 110 | -- |
| 251-829-P | Near Alden | On Rt. 239, 2 miles south of Alden. | Feb. 17, 1964 | -- | -- | -- | -- | -- | -- | -- | 292 | 3.85 |
| 251-845-P | At Gardenville | On Rt. 354, 0.2 mile east of Rt. 277. | Feb. 18, 1964 | -- | -- | -- | -- | -- | -- | -- | 54 | -- |
| | | | Jan. 14, 1965 | 6.4 | -- | -- | 7.8 | 31 | -- | -- | 153 | 6.8 |
| | | | Feb. 2 | 4.0 | -- | -- | 5.2 | 7.3 | -- | -- | 52 | 5.6 |
| 252-834-P | At Town Line | On Town Line Rd. at Cayuga Creek, south of Town Line. | Feb. 17, 1964 | 2.0 | -- | -- | 6.6 | 1.8 | -- | -- | 54 | 3.80 |
| | | | Jan. 14, 1965 | 3.2 | -- | -- | 2.8 | 2.0 | -- | -- | 26 | 6.6 |
| | | | Feb. 2 | 2.0 | -- | -- | 1.4 | 1.2 | -- | -- | 29 | 4.6 |
| 254-823-P | At Darien Center | At intersection of Rts. 77 and 20. | Feb. 17, 1964 | 6.4 | 11 | 1.6 | 217 | 22 | 60 | -- | 632 | 3.30 |
| | | | Jan. 14, 1965 | 2.3 | -- | -- | 0 | 4.4 | -- | -- | 21 | 5.1 |
| | | | Feb. 2 | 1.4 | -- | -- | 1.4 | 4.9 | -- | -- | 33 | 4.8 |
| 254-845-P | Near Williamsville | On Union Rd., 0.8 mile south of Rt. 33. | Feb. 18, 1964 | 9.6 | -- | -- | 36 | 13 | -- | -- | 143 | -- |
| 256-814-P | Near Alexander | At intersection of Rt. 98 and Cookson Rd., 2.5 miles northeast of Alexander. | Feb. 17, 1964 | -- | -- | -- | -- | -- | -- | -- | 57 | 4.20 |
| 256-835-P | Near Clarence | At intersection of Ransom and Schlimmer Rds. southeast of Ellicott Creek and 2 miles south of Clarence. | Feb. 17, 1964 | 3.3 | -- | -- | 62 | 0 | -- | -- | 401 | 3.20 |
| 256-840-P | At Bowmansville | On Martha Dr. off Rt. 33 in front of Bowmansville School. | Feb. 18, 1964 | -- | -- | -- | -- | -- | -- | -- | 124 | 4.00 |
| 257-823-P | At Corfu | On Rt. 33, at Murder Creek, eastside of Corfu. | Feb. 17, 1964 | -- | -- | -- | -- | -- | -- | -- | 66 | 4.00 |
| 258-847-P | Near Williamsville | At intersection of Rts. 263 and 324. | Feb. 18, 1964 | -- | -- | -- | -- | -- | -- | -- | 120 | 4.00 |
| 259-814-P | Near Batavia | On Rt. 33, 2 miles west of Batavia. | Feb. 17, 1964 | 2.2 | -- | -- | 3.0 | 5.6 | -- | -- | 31 | -- |
| | | | Jan. 14, 1965 | 1.0 | -- | -- | .2 | .3 | -- | -- | 11 | 5.6 |
| | | | Feb. 2 | 2.9 | -- | -- | 3.4 | 13 | -- | -- | 70 | 5.0 |

## Table 15.--Chemical analyses of snow (Continued)

| Sampling site number | Location | Point of collection | Date of collection | Calcium (Ca) (ppm) | Magnesium (Mg) (ppm) | Sodium (Na) (ppm) | Sulfate ($SO_4$) (ppm) | Chloride (Cl) (ppm) | Hardness as $CaCO_3$ (ppm) | Dissolved solids at 180°C (ppm) | Specific conductance (micromhos at 25°C) | pH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 259-840-P | Near Clarence | At Brookfield Golf and Country Club on Grenier Rd. | Feb. 18, 1964 | -- | -- | -- | -- | -- | -- | -- | 144 | 4.50 |
| 300-808-P | Near Batavia | At Batavia Golf Club on Rt. 33A. | Feb. 18, 1964 | 9.4 | -- | -- | 67 | 31 | -- | 132 | 270 | 3.90 |
| 301-829-P | At Akron | At Evergreen Cemetery on Bloomingdale Rd. | Feb. 17, 1964 | 11 | -- | -- | 25 | 1.2 | -- | -- | 88 | 4.7 |
| 301-835-P | At Hunts Corners | At intersection of Rt. 268 and Hunts Corners - Akron Rd. | Feb. 17, 1964 | 4.8 | 9.2 | 1.6 | 174 | 28 | 50 | -- | 496 | 3.60 |
| | | | Jan. 14, 1965 | 1.4 | -- | -- | .0 | 1.6 | -- | -- | 14 | 5.0 |
| | | | Feb. 2 | 3.7 | -- | -- | 6.6 | 3.5 | -- | -- | 43 | 4.8 |
| 301-845-P | At Getzville | On Dodge Rd., east of Rt. 270. | Feb. 17, 1964 | -- | -- | -- | -- | -- | -- | -- | 354 | 3.50 |
| 304-849-P | At Beach Ridge | At intersection of Town Line and Hill Rds. | Feb. 17, 1964 | 6.4 | -- | -- | 58 | 20 | -- | 130 | 235 | 3.90 |
| 305-827-P | At Tonawanda Indian Reservation | At intersection of Hopkins and Syke Rds. | Feb. 17, 1964 | -- | -- | -- | -- | -- | -- | -- | 243 | 3.50 |
| 305-838-P | At Rapids | At intersection of Rt. 268 and Goodrich Rd. | Feb. 17, 1964 | -- | -- | -- | -- | -- | -- | -- | 50 | 4.15 |
| 307-834-P | At Dysinger | At intersection of Rt. 93 and Bunker Hill Rd. | Feb. 17, 1964 | -- | -- | -- | -- | -- | -- | -- | 44 | 4.50 |
| 307-841-P | Near Lockport | At intersection of Rt. 78 and Robinson Rd. | Feb. 17, 1964 | 18 | -- | -- | 167 | 22 | -- | 299 | 788 | 3.20 |
| 307-847-P | At Mapleton | At intersection of Mapleton and Aiken Rd. | Feb. 17, 1964 | 3.2 | -- | -- | 7.0 | 2.0 | -- | -- | 39 | -- |

## Table 16.--Chemical analyses of overland flow

Sampling site number.--See appendix A.

| Sampling site number | Location | Point of collection | Date of collection | Time (hours) | Sulfate ($SO_4$) (ppm) | Chloride (Cl) (ppm) | Calcium, magnesium hardness as $CaCO_3$ (ppm) | Dissolved solids at 180°C (ppm) | Specific conductance (micromhos at 25°C) | pH |
|---|---|---|---|---|---|---|---|---|---|---|
| 223-846-A | Near East Otto | On East Otto Rd., 0.3 mile southwest of Swamp Rd. | Mar. 5, 1964 | 0845 | 10 | 0.7 | 17 | -- | 46 | -- |
| 224-841-A | At Ashford Hollow | On Rt. 219, opposite old cemetery. | Mar. 5, 1964 | 0715 | 12 | 2.1 | 21 | -- | 45 | -- |
| 224-843-A | Near Ashford Hollow | On Bowen Rd., 0.7 mile south of Whitford Hollow, on east side of Mount Tug. | Mar. 5, 1964 | 0757 | 10 | .8 | 16 | -- | 38 | -- |
| 225-851-A | Near Otto | On Forty Rd., 0.6 mile northwest of Dake Hill Rd. | Mar. 5, 1964 | 0930 | 21 | -- | -- | 64 | 86 | -- |
| 226-841-A | Near Ashford Hollow | On Connoisarauley Rd., 300 ft west of Rt.219. | Mar. 5, 1964 | 0730 | -- | -- | -- | -- | 180 | -- |
| 227-820-A | Near Freedom | On Osmum Rd., 0.4 mile southeast of Crystal Lake. | Mar. 5, 1964 | 0245 | 8.0 | .7 | 14 | -- | 43 | -- |
| 227-824-A | Near Elton | On Cheeseman Hill Rd., 0.2 mile west of Maple Grove Rd. | Mar. 5, 1964 | 0330 | 16 | .8 | 18 | -- | 54 | -- |
| 228-836-A | Near Riceville | On Beech Tree Rd., 0.2 mile south of Folts Rd. | Mar. 5, 1964 | 0525 | 7.8 | .5 | 8 | -- | 25 | -- |
| 232-824-A | At Arcade | On Rt. 98 at northeast village line. | Mar. 26, 1963 | -- | 17 | 3.7 | -- | -- | 117 | 6.8 |
| 233-857-A | Near Lawtons | On Mile Block Rd., 0.8 mile north of Newtown and 1.4 miles northwest of Lawtons. | Mar. 5, 1964 | -- | 14 | 1.5 | 19 | -- | 59 | -- |
| 234-830-B | Near Sardinia | On Chaffee-Johnston Corners Rd., 0.3 mile east of Johnston Corners. | Mar. 9, 1964 | 1140 | 11 | -- | -- | 46 | 69 | -- |
| 238-820-A | Near Southburg | On Rt. 78, 0.8 mile south of Five Corners. | Mar. 9, 1964 | 1525 | -- | -- | -- | -- | 365 | 4.40 |
| 244-819-A | Near Johnsonburg | On Center Line Rd., 1 mile west of Rt. 98. | Mar. 9, 1964 | 1420 | 13 | .6 | 19 | -- | 52 | -- |
| 244-824-A | Near Sheldon | On Center Line Rd., 0.7 mile east of Sheldon. | Mar. 9, 1964 | 1355 | -- | -- | -- | -- | 264 | -- |
| 245-849-A | Near Hamburg | On Rt. 62, 0.2 mile south of NYS Thruway. | Aug. 7, 1963 | 0900 | 34 | 46 | a/ 37 | -- | 385 | 6.5 |
| 251-809-B | At Linden | On road between Belknap Crossing and West Middleburg, 200 ft east of Little Tonawanda Creek. | Mar. 26, 1963 | -- | 21 | 2.5 | -- | -- | 198 | 7.5 |
| 255-812-D | At Brookville | At gravel pit on Hung Rd., 0.1 mile west of Brookville. | Aug. 9, 1963 | 1400 | 15 | 2.0 | 116 | -- | 269 | 7.0 |

a/ Calcium as Ca

# Table 17.--Chemical analyses of streams at high flow

Sampling point mileage index number.--See appendix A.
Remarks.--Additional analyses for some sampling sites included in tables 18, 19, 20 and 21 are indicated by footnotes in the date of collection column.

| Sampling point mileage index number | Stream | Location | Point of collection | Date of collection | Time (hours) | Sulfate ($SO_4$) (ppm) | Chloride (Cl) (ppm) | Hardness as $CaCO_3$ (ppm) | Dissolved solids at 180°C (ppm) | Specific conductance (micromhos at 25°C) | pH |
|---|---|---|---|---|---|---|---|---|---|---|---|
| E23-69(0.3) | Tributary to Cattaraugus Creek | Near East Arcade | On East Arcade Road, 0.5 mile south of Rt. 78. | Mar. 9, 1964 | 1530 | 12 | -- | -- | 59 | 93 | -- |
| E23(61.7) | Cattaraugus Creek | At East Arcade | At bridge on old Rt. 98, 0.2 mile southwest of East Arcade. | a/Mar. 5, 1964<br>Mar. 9 | 1550<br>1540 | 10<br>-- | 3.7<br>-- | 34<br>-- | --<br>-- | 84<br>398 | --<br>3.90 |
| E23-56-15(0.7) | Tributary to Clear Creek | At Freedom | At bridge on Witt Rd., 0.2 mile east of B&O RR. | Mar. 5, 1964 | 0220 | 13 | 3.3 | 30 | -- | 78 | -- |
| E23-56-9(0.6) | do. | At Sandusky | At bridge on a north-south road off Eagle St., east of Sandusky. | Mar. 5, 1964 | 0200 | -- | -- | -- | -- | 206 | 4.20 |
| E23(54.7) | Cattaraugus Creek | Near Arcade | At gaging station, at bridge on North Woods Rd. | b,c/Mar. 20, 1963<br>Mar. 5, 1964 | 1230<br>0645 | 18<br>12 | 7.0<br>-- | 69<br>-- | 108<br>76 | 170<br>126 | 7.6<br>-- |
| E23-50(1.7) | Hosmer Brook | At Chaffee | On Chaffee-Johnstons Corners Rd. | Mar. 9, 1964 | 1200 | 17 | 3.1 | 48 | -- | 104 | -- |
| E23-50-3-1(0.8) | d/Dry Creek | Near Sardinia | On Allen Rd. | Mar. 9, 1964 | 1145 | 14 | 1.7 | 22 | -- | 58 | -- |
| E23-50(0.2) | Hosmer Brook | At Sardinia | At foot bridge, 0.2 mile from mouth. | a/Mar. 9, 1964 | 1110 | 21 | 7.0 | 82 | -- | 173 | -- |
| E23(51.9) | Cattaraugus Creek | do. | At bridge on Buffalo St. below Hosmer Brook. | Mar. 5, 1964 | 0445 | -- | -- | -- | -- | 218 | -- |
| E23-48(14.0) | Elton Creek | At Farmersville Station | At bridge on Older Hill Rd., 0.3 mile southwest of Farmersville Station. | a/Mar. 5, 1964 | 0305 | 18 | -- | -- | 68 | 98 | -- |
| E23-48-9(0.5) | Tributary to Beaver Lake | Near Farmersville Station | At bridge on Blue St., 1.1 mile north of Siloam Rd. | Mar. 5, 1964 | 0320 | 21 | 3.0 | 34 | -- | 91 | -- |
| E23-48-6(0.1) | Tributary to Elton Creek | At Elton | At bridge on Cheeseman Hill Rd., 0.25 mile east of Elton. | Mar. 5, 1964 | 0345 | 11 | -- | -- | 36 | 47 | -- |
| E23-48-4-1(0.7) | do. | Near Elton | At bridge on Fisher Blake Rd. | Mar. 5, 1964 | 0400 | 19 | 2.8 | 30 | -- | 82 | -- |
| E23-48-3(1.3) | Lime Lake Outlet | At Delevan | At bridge on Worden Rd. | Mar. 5, 1964 | 0415 | -- | -- | -- | -- | 128 | -- |
| E23-48-3-1(0.3) | Tributary to Lime Lake Outlet | do. | On Worden Rd., 0.35 mile southeast of West St. | Mar. 5, 1964 | 0435 | 11 | .9 | 40 | -- | 88 | -- |
| E23-48-1-1(0.1) | Tributary to Stony Creek | Near McKinstry Hollow | On Block Rd., 0.25 mile southeast of Vangilder Rd. | Mar. 5, 1964 | 0450 | 15 | 3.2 | 26 | -- | 61 | -- |
| E23-48(0.6) | Elton Creek | At The Forks | At water discharge partial-record station, at bridge on Creek Rd. | b,c/Mar. 20, 1963<br>Mar. 5, 1964 | 1305<br>0515 | 19<br>19 | 5.0<br>-- | 69<br>-- | 107<br>171 | 170<br>254 | 8.0<br>-- |
| E23-45(0.2) | King Brook | Near Sardinia | At bridge on Creek Rd. | Mar. 5, 1964 | 0555 | -- | -- | -- | -- | 93 | -- |
| E23-43(1.7) | Dresser Creek | do. | At bridge on Middle Rd. | a/Mar. 5, 1964 | 0745 | 14 | 2.9 | 39 | -- | 93 | -- |
| E23-43(0.2) | do. | do. | At bridge on Rt. 39. | a/Mar. 5, 1964 | 0715 | -- | -- | -- | -- | 230 | -- |
| E23(46.9) | Cattaraugus Creek | Near Springville | At bridge off Rt. 39, 0.3 mile east of Van Slyke Rd. | a/Mar. 5, 1964 | 0640 | -- | -- | -- | -- | 242 | -- |
| E23-36(2.7) | Tributary to Cattaraugus Creek | Near Riceville | On Folts Rd. | Mar. 5, 1964 | 0520 | 15 | 1.9 | 48 | -- | 95 | -- |

a/ Additional analyses included in table 18.
b/ Additional analyses included in table 19.
c/ Analyses made on water decanted from suspended sediment samples.
d/ New York State Department of Health considers this to be a tributary to Dry Creek.

# Table 17.--Chemical analyses of streams at high flow (Continued)

| Sampling point mileage index number | Stream | Location | Point of collection | Date of collection | Time (hours) | Sulfate ($SO_4$) (ppm) | Chloride (Cl) (ppm) | Hardness as $CaCO_3$ (ppm) | Dissolved solids at 180°C (ppm) | Specific conductance (micromhos at 25°C) | pH |
|---|---|---|---|---|---|---|---|---|---|---|---|
| E23-33(7.4) | Buttermilk Creek | At West Valley | At bridge below confluence of two branches. | Mar. 5, 1964 | 0545 | 14 | 4.5 | 29 | -- | 82 | -- |
| E23-33(1.5) | do. | Near Springville | At gaging station, at bridge on Hays Hollow Rd. | a,b,e/Jan. 7, 1963 | 1040 | 28 | 4.5 | 98 | 130 | 222 | 7.6 |
| E23-33(0.4) | do. | At Edies Siding | At bridge on Thomas Corners Rd. | Mar. 5, 1964 | 0745 | 36 | -- | -- | 172 | 266 | -- |
| E23-32(3.3) | Spring Brook | At Springville | On North St. east of Sharp St. | Mar. 5, 1964 | 0934 | 4.6 | 3.9 | 34 | -- | 86 | -- |
| E23-30(2.3) | Spooner Creek | Near Springville | At bridge on Rt. 39. | a/Mar. 5, 1964 | 0852 | -- | -- | -- | -- | 171 | -- |
| E23-30-1a(0.6) | Tributary to Spooner Creek | do. | On Belcher Rd., 0.2 mile north of Rt. 39. | Mar. 5, 1964 | 0830 | 11 | 2.4 | -- | -- | 67 | -- |
| E23-27-6(1.4) | Tributary to Connoisarauley Creek | At Bellow Corners | On Dutch Hill Rd. | Mar. 5, 1964 | 0705 | 11 | 3.6 | 28 | -- | 74 | -- |
| E23-27(6.2) | Connoisarauley Creek | At Ashford Hollow | At bridge on Neff Rd. | a/Mar. 5, 1964 | 0740 | 12 | 6.0 | 45 | -- | 111 | -- |
| E23-27-2(2.5) | Tributary to Connoisarauley Creek | Near Ashford Hollow | At bridge on Connoisarauley Rd., near intersection with Maynard Rd. | Mar. 5, 1964 | 0747 | 12 | 2.9 | 22 | -- | 67 | -- |
| E23-20-13(1.0) | Tributary to East Otto Creek | Near East Otto | On Bowen Rd., 0.2 mile north of East Flats Rd. | Mar. 5, 1964 | 0802 | 11 | 3.8 | 58 | -- | 121 | -- |
| E23-20-12(2.7) | Tributary to South Branch Cattaraugus Creek | Near Otto | On Swamp Rd., 1.1 miles east of North Otto Rd. | Mar. 5, 1964 | 0900 | 16 | 2.4 | 46 | -- | 92 | -- |
| E23-20-12-1(1.7) | do. | do. | On North Otto Rd., 0.2 mile south of Hebner Hill Rd. | Mar. 5, 1964 | 0915 | 13 | 3.9 | 32 | -- | 82 | -- |
| E23-20-12(1.2) | do. | do. | On Colvin Rd., 0.2 mile west of Miller Rd. | Mar. 5, 1964 | 0830 | 24 | -- | -- | 70 | 95 | -- |
| E23-20(14.4) | South Branch Cattaraugus Creek | do. | At water discharge partial-record station, 0.2 mile upstream from Mansfield Creek. | b/Mar. 5, 1964 | 0817 | 19 | -- | -- | 106 | 159 | -- |
| E23(17.4) | Cattaraugus Creek | At Gowanda | At bridge on Rt. 39, at gaging station. | a,b,c,f/Mar. 18, 1963 | 1100 | 23 | 5.2 | 90 | 134 | 208 | 7.2 |
| | | | | c/Mar. 25 | 1130 | -- | 5.7 | -- | -- | 199 | 7.1 |
| | | | | c/Mar. 26 | 1000 | -- | 4.2 | -- | -- | 199 | 7.1 |
| | | | | c/Mar. 26 | 1630 | -- | 3.8 | -- | -- | 192 | 7.5 |
| | | | | c/Mar. 26 | 2100 | -- | 3.2 | -- | -- | 213 | 7.7 |
| | | | | c/Mar. 27 | 0030 | -- | 4.2 | -- | -- | 214 | 7.9 |
| | | | | c/Mar. 27 | 0725 | -- | 3.4 | -- | -- | 205 | 7.7 |
| | | | | c/Mar. 27 | 1645 | -- | 4.9 | -- | -- | 221 | 7.8 |
| | | | | Mar. 5, 1964 | 1017 | -- | -- | -- | -- | 245 | -- |
| E23-18(1.4) | Grannis Brook | Near Gowanda | On Quaker Rd. | Mar. 5, 1964 | 1030 | -- | -- | -- | -- | 137 | -- |
| E23-16(0.7) | Tributary to Cattaraugus Creek | At Gowanda | At bridge on Rt. 39, 1 mile west of Gowanda. | Mar. 5, 1964 | 1000 | 17 | 5.0 | 49 | -- | 117 | -- |
| E23-6(10.2) | Clear Creek | At Bagdad | At bridge on Bagdad Rd. | Mar. 5, 1964 | 1044 | -- | -- | -- | -- | 218 | -- |
| E23-6-4-10(0.6) | Tributary to North Branch Clear Creek | Near Langford | On Rt. 75, 200 ft north of Genesee Rd. | Mar. 5, 1964 | 0055 | 17 | 5.8 | 56 | -- | 138 | -- |

a/ Additional analyses included in table 18.
b/ Additional analyses included in table 19.
c/ Analyses made on water decanted from suspended sediment samples.
e/ Bicarbonate ($HCO_3$) 86 ppm.
f/ Additional analyses included in table 20.

## Table 17.--Chemical analyses of streams at high flow (Continued)

| Sampling point mileage index number | Stream | Location | Point of collection | Date of collection | Time (hours) | Sulfate ($SO_4$) (ppm) | Chloride (Cl) (ppm) | Hardness as $CaCO_3$ (ppm) | Dissolved solids at 180°C (ppm) | Specific conductance (micromhos at 25°C) | pH |
|---|---|---|---|---|---|---|---|---|---|---|---|
| E22(1.2) | Muddy Creek | Near Farnham | At water discharge partial-record station at bridge on Reeves Rd. | Mar. 9, 1964 | 1340 | -- | -- | -- | -- | 315 | -- |
| E21(1.5) | Delaware Creek | Near Angola | At water discharge partial-record station at bridge on Rt. 5. | a/Mar. 9, 1964 | 1240 | -- | -- | -- | -- | 220 | -- |
| E20-15(0.2) | Hussey Gulf Stream | At North Collins | On Rt. 62, 0.7 mile south of North Collins. | b/Mar. 5, 1964 | 0135 | 25 | 8.6 | 39 | -- | 118 | -- |
| E20(12.0) | Big Sister Creek | do. | On Rt. 249, 0.5 mile west of North Collins. | Mar. 5, 1964 | 0150 | 21 | 8.2 | 43 | -- | 122 | -- |
| E20-2(5.9) | Rythus Creek | At Eden | On Hammond Dr., 0.2 mile upstream from Rt. 62 bridge. | Mar. 5, 1964 | 0205 | 18 | 6.7 | 26 | -- | 85 | -- |
| E20-2a(0.3) | Tributary to Rythus Creek | Near Eden | On Eden (New Jerusalem) Rd., 1.3 miles west of Rt. 62. | Mar. 5, 1964 | -- | 19 | -- | -- | 82 | 101 | -- |
| E20(2.2) | Big Sister Creek | At Evans Center | At water discharge partial-record station, at bridge on Rt. 5. | Mar. 9, 1964 | 1215 | -- | -- | -- | -- | 202 | -- |
| E15(3.3) | Pike Creek | At Derby | On Pontiac-Derby Rd. | Mar. 5, 1964 | 0240 | 21 | 26 | 38 | -- | 168 | -- |
| E13-58(1.2) | Tributary to Eighteenmile Creek | Near East Concord | On Sharp St., 0.5 mile southeast of Morse Rd. | Mar. 5, 1964 | 1132 | 16 | 1.5 | 52 | -- | 109 | -- |
| E13-57(0.2) | do. | Near Fowlerville | On Snyder Rd., 0.15 mile south of Rt. 219. | Mar. 5, 1964 | 1156 | 17 | 2.9 | 66 | -- | 132 | -- |
| E13(22.8) | Eighteenmile Creek | At Fowlerville | At bridge on Fowler Rd., 0.1 mile west of Rt. 219. | a/Mar. 5, 1964 | 1225 | -- | -- | -- | -- | 173 | -- |
| E13-27(0.5) | Anthony Gulf Stream | At Patchin | On Rt. 219. | Mar. 5, 1964 | 1305 | 17 | 3.2 | 28 | -- | 78 | -- |
| E13(15.3) | Eighteenmile Creek | At No. Boston | At gaging station at bridge on Zimmerman Rd. | b,c/Mar. 20, 1963<br>Mar. 4, 1964 | 1440<br>2310 | 24<br>28 | 7.5<br>-- | 64<br>-- | 104<br>170 | 164<br>259 | 7.6<br>-- |
| E13-8(1.6) | Neuman Creek | Near Hamburg | On Newton Rd., 0.8 mile east of McKinley Pkwy. | Mar. 4, 1964 | 2255 | 22 | 10 | 56 | -- | 146 | -- |
| E13-6(2.6) | Hampton Brook | do. | On Kehe Rd. | Mar. 4, 1964 | 2325 | 23 | 6.1 | 47 | -- | 122 | -- |
| E13-4(18.8) | South Branch Eighteenmile Creek | At Wyandale | On Genesee Rd., 300 ft east of crossroads in Wyandale. | Mar. 5, 1964 | 0035 | 16 | -- | -- | 95 | 134 | -- |
| E13-4-14(0.1) | Tributary to South Branch Eighteenmile Creek | Near New Oregon | On New Oregon Rd., 100 ft north of Belcher Rd. | Mar. 5, 1964 | 0020 | 20 | 6.0 | 46 | -- | 132 | -- |
| E13-4(2.9) | South Branch Eighteenmile Creek | At Eden Valley | At water discharge partial-record station, at bridge 300 ft upstream from Rt. 62. | b/Mar. 4, 1964 | 2340 | -- | -- | -- | -- | 188 | -- |
| E11(1.3) | Unnamed stream | Near Clifton Heights | On Heltz Rd. 1 mile north of Southwestern Blvd. | Mar. 5, 1964 | 0255 | 38 | 28 | 57 | -- | 205 | -- |
| E3(5.3) | Rush Creek | Near Hamburg | On Bay View Rd. northwest of Armor. | Mar. 4, 1964 | 2245 | -- | -- | -- | -- | 396 | -- |
| E2(3.5) | Smoke Creek | At Lackawanna | At water discharge partial-record station, at bridge on Abbott Rd. | a/Mar. 5, 1964 | 1000 | -- | -- | -- | -- | 218 | -- |
| E1-59-1-4(0.6) | Tributary to Plato Creek | Near Java Village | On Michigan Rd., 3 miles south of Java Village. | Mar. 9, 1964 | 1305 | 24 | 4.0 | 94 | -- | 207 | -- |

a/ Additional analyses included in table 18.
b/ Additional analyses included in table 19.
c/ Analyses made on water decanted from suspended sediment samples.

## Table 17.--Chemical analyses of streams at high flow (Continued)

| Sampling point mileage index number | Stream | Location | Point of collection | Date of collection | Time (hours) | Sulfate ($SO_4$) (ppm) | Chloride (Cl) (ppm) | Hardness as $CaCO_3$ (ppm) | Dissolved solids at 180°C (ppm) | Specific conductance (micromhos at 25°C) | pH |
|---|---|---|---|---|---|---|---|---|---|---|---|
| E1-59(0.0) | Plato Creek | At Java Village | On Michigan Rd., 0.6 mile south of Java Village. | Mar. 9, 1964 | 1315 | 20 | 3.7 | 80 | -- | 173 | -- |
| E1-58-2-3(0.4) | Tributary to Buffalo Creek | Near Java Center | On Cattaraugus Rd., 200 ft south of Tory Hill Rd. | Mar. 9, 1964 | 1650 | 109 | 21 | 117 | -- | 311 | -- |
| E1-45(0.8) | Glade Creek | At Strykersville | At bridge on Dutch Hollow Rd. | Mar. 9, 1964 | 1335 | 21 | 9.7 | 64 | -- | 166 | -- |
| E1(31.8) | Buffalo Creek | Near Wales Hollow | At gaging station, at bridge on Marlou Rd. | b,c/Mar. 20, 1963 | 0930 | 23 | 5.8 | 78 | 120 | 186 | 8.0 |
| | | | | Mar. 5, 1964 | 1440 | 16 | -- | -- | 96 | 158 | -- |
| | | | | Mar. 5 | 1625 | -- | -- | -- | -- | 179 | -- |
| E1-31(2.0) | Stony Bottom Creek | Near Wales Center | On Rt. 20A, 2.2 miles east of Rt.358. | Mar. 5, 1964 | 1230 | 15 | 3.0 | 40 | -- | 101 | -- |
| E1-30(11.6) | Hunter Creek | Near Holland | On Whitney Rd., 0.6 mile east of Hunter Creek Rd. | Mar. 5, 1964 | 1525 | 16 | 7.2 | 34 | -- | 100 | -- |
| E1-30-6(0.3) | Tributary to Hunter Creek | do. | At Crossing of Hunter Creek Rd., 100 ft north of Sanders Rd. | Mar. 5, 1964 | 1555 | 34 | 5.0 | 49 | -- | 123 | -- |
| E1-30(3.7) | Hunter Creek | At Colegrave | At bridge on Center Line Rd. | a/Mar. 5, 1964 | 1646 | 16 | 4.6 | 55 | -- | 130 | -- |
| E1-26(1.6) | Tributary to Buffalo Creek | Near Wales Center | On Rt. 20A, 0.1 mile west of Rt. 78. | Mar. 5, 1964 | 1755 | 13 | 3.1 | 34 | -- | 84 | -- |
| E1(10.4) | Buffalo Creek | At Gardenville | At bridge on Union Rd., 700 ft upstream from gaging station. | b,g/Mar. 5, 1964 | 0900 | 34 | -- | -- | 204 | 324 | -- |
| E1-6(35.4) | Cayuga Creek | At Toziers | On Center Line Rd., 0.2 mile east of Toziers Corners. | Mar. 9, 1964 | 1405 | 17 | 4.0 | 50 | -- | 120 | -- |
| E1-6-30-4(0.3) | French Brook | At Bennington | On Rt. 354, 0.5 mile east of Rt. 77. | Mar. 5, 1964 | 1620 | -- | -- | -- | -- | 194 | 4.05 |
| E1-6(24.9) | Cayuga Creek | At Folsomdale | On Loomis Rd. | Mar. 5, 1964 | 1310 | -- | -- | -- | -- | 141 | -- |
| E1-6-7-7(0.2) | Tributary to Little Buffalo Creek | Near Marilla | At culvert on Bullis Rd., at intersection with Town Line Rd. | a/Mar. 5, 1964 | 0545 | -- | -- | -- | -- | 156 | -- |
| E1-4-15-23(0.8) | Graff Brook | At East Concord | On Allen Rd., 0.1 mile northeast of Rt. 240. | Mar. 5, 1964 | 1015 | 11 | 3.3 | 30 | -- | 79 | -- |
| E1-4-15(15.3) | West Branch Cazenovia Creek | At Footes | At private bridge off Rt. 240, 0.2 mile south of Footes Rd. | a/Mar. 5, 1964 | 1043 | 15 | 3.7 | 64 | -- | 137 | -- |
| E1-4-15-19(0.1) | Crump Brook | Near Glenwood | On Rt. 240. | Mar. 5, 1964 | 1103 | -- | -- | -- | -- | 143 | -- |
| E1-4-14(18.2) | h/Tributary to East Branch Cazenovia Creek | At Protection | On Miller Rd., 0.2 mile east of Penn. RR. | Mar. 9, 1964 | 1250 | 17 | 8.4 | 60 | -- | 149 | -- |
| E1-4-14(13.9) | East Branch Cazenovia Creek | At Holland | On Glenwood-Holland Rd. | Mar. 5, 1964 | 1442 | -- | -- | -- | -- | 177 | -- |
| E1-4-14(8.1) | do. | At South Wales | At water discharge partial-record station, at bridge on Darling Rd. | b,c/Mar. 20, 1963 | 1050 | 22 | 11 | 56 | 94 | 165 | 7.7 |
| | | | | Mar. 5, 1964 | 1708 | 25 | 7.0 | 68 | -- | 153 | -- |
| E1-4(4.1) | Cazenovia Creek | At Ebenezer | At gaging station at bridge on Ridge Rd. | a,b,c/Mar. 20, 1963 | 1630 | 26 | 12 | 68 | 116 | 188 | 7.9 |
| | | | | Mar. 5, 1964 | 0940 | -- | -- | -- | -- | 223 | -- |
| 0158-15-7(0.4) | Tributary to Scajaquada Creek | At Lancaster | On Rt. 78. | Mar. 5, 1964 | 0825 | -- | -- | -- | -- | 364 | -- |

a/ Additional analyses included in table 18.
b/ Additional analyses included in table 19.
c/ Analyses made on water decanted from suspended sediment samples.
g/ Additional analyses included in table 21.
h/ New York State Department of Health considers this to be the headwaters of East Branch Cazenovia Creek.

# Table 17.--Chemical analyses of streams at high flow (Continued)

| Sampling point mileage index number | Stream | Location | Point of collection | Date of collection | Time (hours) | Sulfate ($SO_4$) (ppm) | Chloride (Cl) (ppm) | Hardness as $CaCO_3$ (ppm) | Dissolved solids at 180°C (ppm) | Specific conductance (micromhos at 25°C) | pH |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0158-12(106.0) | Tonawanda Creek | At Southburg | On Rt. 98, south of Sheer Rd. | Mar. 5, 1964 | 1318 | 11 | 2.2 | 49 | -- | 111 | -- |
| 0158-12-77(0.2) | East Fork Tonawanda Creek | Near North Java | At bridge on Rt. 98. | Mar. 9, 1964 | 1445 | -- | -- | -- | -- | 248 | -- |
| 0158-12(100.6) | Tonawanda Creek | Near Johnsonburg | At water discharge partial-record station, at bridge on Rt. 98. | b/Mar. 5, 1964 | 1247 | -- | -- | -- | -- | 205 | -- |
| | | | | Mar. 9 | 1430 | 18 | 3.4 | 85 | -- | 178 | -- |
| 0158-12-66(0.1) | Stony Brook | At Varysburg | At bridge on Rt. 20A. | a/Mar. 5, 1964 | 0445 | -- | -- | -- | -- | 194 | -- |
| | | | | Mar. 5 | 1725 | 18 | 5.8 | 78 | -- | 160 | -- |
| 0158-12-46-2(1.9) | Tributary to Crow Creek | At Attica Center | On Baker Rd., 0.1 mile north of Rt. 238. | Mar. 5, 1964 | 1100 | 14 | 4.4 | 34 | -- | 89 | -- |
| 0158-12-41(0.1) | Tannery Brook | At Attica | At bridge on Rt. 98. | a/Mar. 5, 1964 | 0415 | -- | -- | -- | -- | 184 | -- |
| | | | | Mar. 5 | 1705 | 29 | 8.5 | 79 | -- | 173 | -- |
| 0158-12-39-3(1.2) | Baker Brook | Near Dale | On Brewer Rd., 2.7 miles north of Attica Center. | Mar. 5, 1964 | 1140 | 16 | 4.3 | 60 | -- | 132 | -- |
| 0158-12-33a(1.8) | Tributary to Tonawanda Creek | At Brookville | On Hung Rd., 0.2 mile northwest of Brookville. | Mar. 5, 1964 | 0526 | -- | -- | -- | -- | 289 | -- |
| 0158-12-32-14(0.3) | Tributary to Little Tonawanda Creek | Near Dale | On Lower Dale Rd., 0.3 mile southeast of Millers Crossing. | Mar. 5, 1964 | 0930 | 17 | 3.8 | 53 | -- | 129 | -- |
| 0158-12-32-9(0.2) | Dusing Gulf Stream | do. | On Dale Rd., 1.5 miles north of Dale. | Mar. 5, 1964 | 0905 | 17 | 3.1 | 78 | -- | 167 | -- |
| 0158-12-32-8(1.8) | Middlebury Brook | Near West Middlebury | At bridge, 0.6 mile east of West Middlebury at Dutton Hill. | Mar. 5, 1964 | -- | 19 | -- | -- | 104 | 151 | -- |
| 0158-12-32(9.4) | Little Tonawanda Creek | At Linden | At gaging station at bridge in Linden. | b/Mar. 5, 1964 | 0750 | 19 | -- | -- | 100 | 152 | -- |
| 0158-12-32-4(0.0) | Tributary to Little Tonawanda Creek | Near Linden | On Rt. 20, east of bridge over Little Tonawanda Creek. | Mar. 5, 1964 | 0718 | -- | -- | -- | -- | 756 | -- |
| 0158-12-32-1(0.7) | do. | Near East Alexander | On Putnam Rd., 1.5 miles northeast of East Alexander. | Mar. 5, 1964 | 0445 | 28 | 6.9 | 98 | -- | 209 | -- |
| 0158-12-31b(0.2) | Tributary to Tonawanda Creek | Near Batavia | On Creek Rd., 0.5 mile south of WBTA radio tower and 0.1 mile east of Tonawanda Creek. | Mar. 5, 1964 | 0410 | 32 | -- | -- | 187 | 264 | -- |
| 0158-12-31a(2.9) | do. | Near North Alexander | On Rt. 98, 0.3 mile south of Cookson Rd. | Mar. 5, 1964 | 0630 | -- | -- | -- | -- | 237 | -- |
| 0158-12(69.2) | Tonawanda Creek | At Batavia | At gaging station, 500 ft upstream from bridge on Walnut St. | b,c/Mar. 18, 1963 | 1905 | 19 | 8.5 | 90 | 144 | 217 | 7.4 |
| | | | | c/Mar. 20 | 0710 | 24 | 9.8 | 102 | 154 | 240 | 7.7 |
| | | | | Mar. 5, 1964 | 0320 | 33 | -- | -- | 230 | 356 | -- |
| 0158-12-25-1(0.3) | Tributary to Tonawanda Creek | At North Pembroke | On Beckwith Rd., 0.4 mile east of Maple St. | Mar. 5, 1964 | -- | 33 | -- | -- | 176 | 265 | -- |
| 0158-12-22a(0.1) | do. | Near Indian Falls | On Indian Falls Rd., east-southeast of Indian Falls. | Mar. 5, 1964 | 0155 | -- | -- | -- | -- | 267 | -- |
| 0158-12-20a(0.0) | do. | At Indian Falls | On Christie Rd., 100 ft east of Rt. 77. | Mar. 5, 1964 | 0100 | 28 | 8.5 | 128 | -- | 269 | -- |
| 0158-12(46.9) | Tonawanda Creek | Near Alabama | At gaging station, at bridge on Meadville Rd. | b,c/Mar. 21, 1963 | 1020 | 32 | 13 | 124 | 176 | 276 | 8.2 |
| | | | | Mar. 5, 1964 | 0450 | 47 | -- | -- | 260 | 420 | -- |
| 0158-12-14(0.5) | Tributary to Tonawanda Creek | Near Swifts Mills | At bridge on Brunning Rd., 0.2 mile from Scotland Rd. | a/Mar. 5, 1964 | 0255 | -- | -- | -- | -- | 238 | -- |

a/ Additional analyses included in table 18.
b/ Additional analyses included in table 19.
c/ Analyses made on water decanted from suspended sediment samples.

## Table 17.--Chemical analyses of streams at high flow (Continued)

| Sampling point mileage index number | Stream | Location | Point of collection | Date of collection | Time (hours) | Sulfate ($SO_4$) (ppm) | Chloride (Cl) (ppm) | Hardness as $CaCO_3$ (ppm) | Dissolved solids at 180°C (ppm) | Specific conductance (micromhos at 25°C) | pH |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0158-12-11-2(0.5) | Tributary to Ledge Creek | Near Akron | On Tesnow Rd., 0.6 mile north of Sparling Rd. | Mar. 5, 1964 | 0230 | -- | -- | -- | -- | 458 | -- |
| 0158-12-11(29.5) | Murder Creek | At Darien | At bridge on Griswold Rd., 0.2 mile south of Rt. 238. | a/Mar. 5, 1964 | 0330 | -- | -- | -- | -- | 137 | -- |
| | | | | Mar. 5 | 1645 | 23 | 5.7 | 44 | -- | 118 | -- |
| 0158-12-11-1(29.5) | Tributary to Murder Creek | Near Corfu | On Boyce Rd., 0.1 mile north of Rt. 33. | Mar. 5, 1964 | 0130 | -- | -- | -- | -- | 361 | -- |
| | | | | Mar. 5 | 1435 | -- | -- | -- | -- | 279 | -- |
| 0158-12-11-1(12.4) | Murder Creek | At Pembroke | At Rt. 5 (Main St.) crossing. | Mar. 5, 1964 | 1450 | -- | -- | -- | -- | 278 | -- |
| 0158-12-11-1-3a(0.6) | Tributary to Murder Creek | do. | At Rt. 5 (Main St.) crossing, 0.9 mile west of Pembroke. | Mar. 5, 1964 | 1510 | 26 | 22 | 62 | -- | 184 | -- |
| 0158-12-10(2.0) | Tributary to Tonawanda Creek | At Sand Hill | On Fletcher Rd., 0.1 mile northeast of Rapids Rd. | Mar. 5, 1964 | 0755 | -- | -- | -- | -- | 272 | -- |
| 0158-12-9-1(2.4) | Tributary to Beeman Creek | Near Hunts Corners | On Keller Rd., 0.25 mile east of Strickler Rd. | Mar. 5, 1964 | 0815 | -- | -- | -- | -- | 324 | -- |
| 0158-12(19.5) | Tonawanda Creek | At Rapids | At gaging station, at bridge at Rapids. | b,c/Mar. 19, 1963 | 1655 | 35 | 16 | 114 | 176 | 281 | 7.8 |
| | | | | Mar. 5, 1964 | 0730 | 94 | -- | -- | 314 | 467 | -- |
| 0158-12-8(15.1) | Mud Creek | At Wolcottsville | On Royalton Center Rd., 0.5 mile north of Wolcottsville. | Mar. 5, 1964 | 0530 | 33 | -- | -- | 123 | 170 | -- |
| 0158-12-8-4b(0.3) | Tributary to Mud Creek | do. | At Wolcottsville Rd. crossing, 0.2 mile north of Fisk Rd. | Mar. 5, 1964 | 0520 | 35 | 5.4 | 72 | -- | 174 | -- |
| 0158-12-8-4a(2.2) | do. | Near Wolcottsville | On Royalton Center Rd., 1.9 miles north-northwest of Wolcottsville. | Mar. 5, 1964 | 0545 | 27 | 7.3 | 49 | -- | 133 | -- |
| 0158-12-8-4(0.4) | do. | Near Rapids | On Simms Rd., 0.4 mile east of Riddle Rd. | Mar. 5, 1964 | 0615 | 19 | 3.5 | 33 | -- | 89 | -- |
| 0158-12-8-2(0.2) | do. | At Raymond | On Rapids Rd., 0.3 mile southeast of Minnick Rd. | Mar. 5, 1964 | 0715 | 40 | 9.0 | 94 | -- | 217 | -- |
| 0158-12-6-4a(0.1) | Tributary to Got Creek | Near Clarence Center | On Roll Rd., east of Newhouse Rd. | Mar. 5, 1964 | 0850 | -- | -- | -- | -- | 1,100 | -- |
| 0158-12-6-3-1(1.3) | Tributary to Black Creek | At Swormville | On Transit Rd. (Rt. 78), 0.1 mile north of Lapp Rd. | Mar. 5, 1964 | 0920 | 34 | 7.8 | 56 | -- | 148 | -- |
| 0158-12-3a(2.8) | Tributary to Tonawanda Creek | Near Wendelville | On Meyer Rd., 0.2 mile east of Beach Ridge Rd. | Mar. 5, 1964 | 1230 | 46 | 17 | 128 | -- | 300 | -- |
| 0158-12-3(10.0) | Bull Creek | Near Mapleton | On road north from Constock Corners, 0.2 mile north of NYC RR. | Mar. 5, 1964 | 1100 | 42 | -- | -- | 168 | 228 | -- |
| 0158-12-3(7.1) | do. | At Mapleton | At bridge on Mapleton Rd., 0.35 mile east of Mapleton. | a/Mar. 5, 1964 | 1045 | 48 | 18 | 112 | -- | 272 | -- |
| 0158-12-3-3(0.9) | Tributary to Bull Creek | do. | On Mapleton Rd., 0.6 mile west of Aiken Rd. | Mar. 5, 1964 | 1030 | -- | -- | -- | -- | 356 | -- |
| 0158-12-3-1a(0.8) | Tributary to Sawyer Creek | Near St.Johnsbury | On Nash Rd., 0.9 mile north of Rt.62. | Mar. 5, 1964 | 1130 | 19 | 18 | 107 | -- | 268 | -- |
| 0158-12-3(1.4) | Bull Creek | At Hoffman | On Town Line Rd., 1 mile south of Killean Rd. | a,b/Mar. 5, 1964 | 1005 | 37 | 19 | 85 | -- | 239 | -- |

a/ Additional analyses included in table 18.
b/ Additional analyses included in table 19.
c/ Analyses made on water decanted from suspended sediment samples.

## Table 17.--Chemical analyses of streams at high flow (Continued)

| Sampling point mileage index number | Stream | Location | Point of collection | Date of collection | Time (hours) | Sulfate ($SO_4$) (ppm) | Chloride (Cl) (ppm) | Hardness as $CaCO_3$ (ppm) | Dissolved solids at 180°C (ppm) | Specific conductance (micromhos at 25°C) | pH |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0158-12-1(43.1) | Elevenmile Creek | Near Darien Center | Near Seven Day Rd. on County Line Road. | Mar. 5, 1964 | 1355 | 22 | 4.7 | 40 | -- | 106 | -- |
| 0158-12-1-18-1(1.2) | Durkee Creek | Near Alden | On County Line Rd., near Seven Day Rd. | Mar. 5, 1964 | 1535 | 18 | -- | -- | 74 | 100 | -- |
| | | | | Mar. 5 | 0245 | 45 | 3.0 | 36 | -- | 92 | -- |
| 0158-12-1(28.8) | Ellicott Creek | At Mill Grove | At bridge on Ellicott Rd., at gaging station. | b,c/Mar. 20, 1963 | 0805 | 25 | 9.2 | 87 | 142 | 209 | 8.0 |
| | | | | Mar. 5, 1964 | 0640 | 40 | -- | -- | 140 | 212 | -- |
| 0158-12-1(14.1) | do. | At Williamsville | At gaging station, at bridge on Wehrle Dr. | a,b,c/Mar. 19, 1963 | 0830 | 33 | 13 | 92 | 150 | 235 | 7.4 |
| | | | | Mar. 5, 1964 | 0730 | 35 | -- | -- | 192 | 300 | -- |
| 0158-12-1-5a(0.6) | Drainage Ditch | Near Getzville | On N. French Rd., 0.5 mile east of Sweet Home Rd. | Mar. 5, 1964 | 0945 | 48 | 8.1 | 100 | -- | 226 | -- |
| 0158-12-7-1(3.2) | Tributary to Barge Canal | Near Lockport | On Beattie Ave., 0.1 mile north of Hamm Rd. | Mar. 5, 1964 | 0655 | -- | -- | -- | -- | 324 | -- |

a/ Additional analyses included in table 18.
b/ Additional analyses included in table 19.
c/ Analyses made on water decanted from suspended sediment samples.

# Table 18.--Chemical analyses of streams at low flow

Sampling point mileage index number.--See appendix A.

Remarks.--Additional analyses for some sampling sites included in tables 17, 19 & 20, and are indicated by footnotes in the date of collection column.

| Sampling point mileage index number | Stream | Location | Point of collection | Date of collection | Time (hours) | Sulfate ($SO_4$) (ppm) | Chloride (Cl) (ppm) | Hardness as $CaCO_3$ (ppm) | Specific conductance (micromhos at 25°C) | pH |
|---|---|---|---|---|---|---|---|---|---|---|
| E23(65.7) | Cattaraugus Creek | At East Java | At bridge on Chaffee Rd. | July 2, 1963 | 1400 | 15 | 6.8 | 91 | 196 | 7.5 |
| E23(61.7) | do. | At East Arcade | At bridge on old Rt. 98, 0.2 mile southwest of East Arcade. | a/July 2, 1963<br>June 26, 1964 | 1430<br>1128 | --<br>-- | --<br>-- | --<br>-- | 286<br>270 | 7.9<br>7.3 |
| E23-67(0.7) | Spring Brook | do. | At bridge on Allen Brook Rd. | July 2, 1963 | 1455 | 27 | 5.8 | 140 | 341 | 8.3 |
| E23(56.7) | Cattaraugus Creek | At Arcade | At bridge on Rt. 98, 0.1 mile upstream from Clear Creek. | b/July 2, 1963 | 1530 | 17 | 8.8 | 136 | 288 | 8.1 |
| E23-56(7.5) | Clear Creek | At Freedom | At bridge on Scott Rd., east of Freedom. | July 4, 1963 | 1340 | 8.4 | 1.7 | 80 | 169 | 8.0 |
| E23-56(6.0) | do. | Near Freedom | At bridge on Rt. 98, west of Freedom. | July 4, 1963 | 1435 | 25 | 13 | 126 | 305 | 8.5 |
| E23-56(4.7) | do. | At Sandusky | At bridge on Rt. 98. | July 4, 1963 | 1425 | -- | -- | -- | 282 | 8.1 |
| E23-56-11(0.1) | Skim Lake Outlet | do. | At bridge on Rt. 98. | July 4, 1963 | 1615 | -- | -- | -- | 264 | 8.0 |
| E23-(54.7) | Cattaraugus Creek | Near Arcade | At gaging station, at bridge on North Woods Rd. | a,b/July 2, 1963 | 1605 | 18 | 9.7 | 138 | 295 | 8.0 |
| E23-51(0.8) | Tributary to Cattaraugus Creek | At Cheery Tavern near Yorkshire | At bridge on Rt. 39. | July 4, 1963 | 1110 | 31 | 17 | 241 | 491 | 7.6 |
| E23-50(1.0) | Hosmer Brook | At Sardinia | do. | a/July 4, 1963<br>July 12 | 0920<br>1315 | --<br>-- | --<br>-- | --<br>-- | 413<br>393 | 7.9<br>8.3 |
| E23-50(0.2) | do. | do. | At foot bridge, 0.2 mile from mouth. | July 4, 1963<br>May 7, 1964<br>July 22<br>Sept 8 | 1000<br>1415<br>0957<br>1130 | 31<br>33<br>37<br>31 | 10<br>10<br>9.0<br>8.2 | 212<br>201<br>212<br>148 | 411<br>410<br>424<br>324 | 8.0<br>7.8<br>7.4<br>8.0 |
| E23-48(13.0) | Elton Creek | Near Farmersville Station | At bridge on Older Hill Rd., 0.8 mile southwest of Farmersville Station. | July 4, 1963 | 1250 | 15 | 8.8 | 111 | 279 | 7.8 |
| E23-48(8.1) | do. | At Elton | At bridge on Marble Springs Rd. | July 4, 1963 | 1340 | 20 | 6.0 | 120 | 314 | 8.3 |
| E23-48(3.6) | do. | At Delevan | At bridge on Mill St. | July 4, 1963<br>July 12 | 1220<br>1410 | --<br>-- | --<br>-- | --<br>-- | 354<br>310 | 8.2<br>8.2 |
| E23-48-3(4.8) | Lime Lake Outlet | At Lime Lake | At foot bridge at lake outlet | July 4, 1963 | 1310 | -- | -- | -- | 288 | 8.4 |
| E23-48-3(0.4) | do. | At Delevan | At bridge on Mill St. | July 4, 1963 | 1240 | -- | -- | -- | 280 | 7.7 |
| E23-48(0.6) | Elton Creek | At The Forks | At highway bridge. | a,b/July 5, 1963 | 1325 | 25 | 5.6 | 139 | 316 | 7.8 |
| E23-43(1.7) | Dresser Creek | Near Sardinia | At water discharge partial-record station, at bridge on Creek Rd. | a/July 4, 1963 | 0855 | 25 | 2.8 | 137 | 276 | 7.9 |
| E23-43(0.2) | do. | At Sardinia | At bridge on Rt. 39. | a/July 4, 1963 | 0830 | 43 | 3.0 | 180 | 357 | 7.9 |
| E23-42(1.8) | Hyler Creek | Near Sardinia | At bridge on Middle Rd. | July 4, 1963 | 1110 | 19 | 3.2 | 75 | 173 | 8.0 |
| E23-42(0.0) | do. | do. | At bridge on Rt. 39. | July 4, 1963 | 1030 | 35 | 4.0 | 134 | 272 | 8.1 |
| E23(46.9) | Cattaraugus Creek | Near Springville | At bridge off Rt. 39, 0.3 mile east of Van Slyke Rd. | a/July 5, 1963 | 1250 | 24 | 8.2 | 156 | 319 | 8.3 |
| E23-33(5.0) | Buttermilk Creek | At Riceville Station | At bridge on Fox Valley Rd. | b/July 4, 1963 | 1700 | 27 | 10 | 141 | 310 | 8.1 |

a/ Additional analyses included in table 17.
b/ Additional analyses included in table 19.

# Table 18.--Chemical analyses of streams at low flow (Continued)

| Sampling point mileage index number | Stream | Location | Point of collection | Date of collection | Time (hours) | Sulfate ($SO_4$) (ppm) | Chloride (Cl) (ppm) | Hardness as $CaCO_3$ (ppm) | Specific conductance (micromhos at 25°C) | pH |
|---|---|---|---|---|---|---|---|---|---|---|
| E23-33-5(1.0) | Gooseneck Creek | At Riceville | At bridge on Goose Neck Rd. | July 4, 1963 | 1610 | 14 | 2.5 | 104 | 215 | 8.2 |
| E23-33(1.5) | Buttermilk Creek | Near Springville | At gaging station, at bridge on Hayes Hollow Rd. | a/July 4, 1963 | 0915 | 33 | 50 | 207 | 445 | 7.3 |
| E23-32(4.0) | Spring Brook | do. | At bridge on Middle Rd. | July 4, 1963 | 1115 | -- | -- | -- | 363 | 8.1 |
| | | | | July 12, | 1200 | -- | -- | -- | 385 | 8.1 |
| E23-32(2.6) | do. | At Springville | At foot bridge, upstream from Maple St. | July 4, 1963 | 1010 | 25 | 19 | 188 | 384 | 7.9 |
| | | | | May 7, 1964 | 1145 | 26 | 14 | 192 | 399 | 7.5 |
| | | | | July 2 | 0937 | 25 | 14 | 188 | 399 | 7.6 |
| | | | | Sept. 9 | 0825 | 30 | 16 | 200 | 414 | 7.7 |
| E23-32(0.1) | do. | At Felton Bridge near Springville | 500 ft upstream from Cattaraugus Creek | July 4, 1963 | 1030 | -- | -- | -- | 428 | 7.9 |
| E23-30(4.8) | Spooner Creek | At Concord | At bridge on Concord Rd. | May 7, 1964 | 1320 | 22 | 2.0 | 121 | 249 | 7.7 |
| | | | | July 21 | 1110 | 26 | 3.6 | 133 | 273 | 7.8 |
| | | | | Sept. 2 | 1000 | 27 | 4.0 | 139 | 287 | 7.9 |
| E23-30(2.3) | do. | Near Springville | At bridge on Rt. 39. | a/July 4, 1963 | 0910 | -- | -- | -- | 374 | 8.1 |
| E23-30(0.4) | do. | Near Scobey Bridge | At bridge on Tefft Rd. | July 4, 1963 | 1215 | 54 | 6.0 | 213 | 414 | 8.1 |
| E23-28(0.1) | Derby Brook | At Frye Bridge near Springville | At bridge on Zoar Valley Rd. | July 4, 1963 | 1330 | -- | -- | -- | 418 | 8.4 |
| E23-27(6.2) | Connoisarauley Creek | At Ashford Hollow | At bridge on Neff Rd. | a/July 4, 1963 | 1345 | 18 | 111 | 218 | 525 | 7.0 |
| E23-27(0.1) | do. | At Frye Bridge near Springville | At bridge on Hammond Hill Rd. | July 4, 1963 | 1300 | 37 | 15 | 177 | 378 | 8.0 |
| E23-25(0.3) | Coon Brook | Near Zoar Bridge near Springville | At bridge on Zoar Valley Rd. | July 4, 1963 | 1150 | 80 | 12 | 211 | 419 | 7.2 |
| E23(26.9) | Cattaraugus Creek | At Zoar Bridge near Gowanda | At bridge on road to Otto off Zoar Valley Rd. | b/July 5, 1963 | 1700 | 32 | 10 | 160 | 339 | 7.8 |
| E23-21(0.2) | Waterman Brook | Near Zoar Bridge near Springville | At first bridge upstream from mouth. | July 4, 1963 | 1500 | 44 | 5.7 | 189 | 383 | 8.2 |
| | | | | July 12 | 1105 | -- | -- | -- | 381 | 8.1 |
| E23-20(18.5) | South Branch Cattaraugus Creek | At East Otto | At bridge on north side of East Otto. | July 5, 1963 | 1540 | -- | -- | -- | 362 | 7.3 |
| E23-20-12(0.6) | Tributary to South Branch Cattaraugus Creek | Near Otto | At bridge on Miller Rd., 0.3 mile south of Colvin Rd. | July 5, 1963 | 1500 | -- | -- | -- | 379 | 6.9 |
| E23-20(14.4) | South Branch Cattaraugus Creek | do. | At water discharge partial-record station, 0.2 mile upstream from Mansfield Creek. | a,b/July 5, 1963 | 1430 | 27 | 9.0 | 158 | 336 | 7.4 |
| E23-20-11(5.5) | Mansfield Creek | At Maples | At bridge on Kent Rd., 0.6 mile east of Maples. | July 4, 1963 | 1430 | 21 | 6.2 | 127 | 262 | 7.9 |
| E23-20-11(1.8) | do. | Near Eddyville | At bridge on Maples Road, 0.6 mile east of Scott Corners Rd. | July 5, 1963 | 1320 | -- | -- | -- | 365 | 7.9 |
| | | | | May 18, 1964 | 1205 | 21 | 4.0 | 118 | 225 | 7.7 |
| | | | | July 21 | 1255 | 22 | 6.0 | 116 | 252 | 7.9 |
| | | | | Sept. 3 | 1325 | 24 | 6.2 | 124 | 269 | 7.9 |
| E23-20-11-2(2.0) | Jersey Hollow Brook | Near Otto | At bridge on Jersey Hollow Rd. | July 5, 1963 | 1245 | -- | -- | -- | 302 | 7.5 |
| E23-20-7(0.3) | Gowan Hollow Brook | At Cattaraugus | At bridge at east side of Cattaraugus. | July 5, 1963 | 1000 | 98 | 31 | 186 | 440 | 6.6 |

a/ Additional analyses included in table 17.
b/ Additional analyses included in table 19.

## Table 18.--Chemical analyses of streams at low flow (Continued)

| Sampling point mileage index number | Stream | Location | Point of collection | Date of collection | Time (hours) | Sulfate ($SO_4$) (ppm) | Chloride (Cl) (ppm) | Hardness as $CaCO_3$ (ppm) | Specific conductance (micromhos at 25°C) | pH |
|---|---|---|---|---|---|---|---|---|---|---|
| E23-20(9.4) | South Branch Cattaraugus Creek | At Cattaraugus | Near south end of Skinner Hollow, 0.25 mile downstream from confluence with Gowan Hollow Brook. | July 5, 1963 | 1055 | -- | -- | -- | 336 | 8.2 |
| E23-20(1.2) | do. | At Forty Bridge near Gowanda | At bridge on Forty Rd. | July 4, 1963 | 1605 | 126 | 26 | 187 | 416 | 6.4 |
| E23(19.4) | Cattaraugus Creek | Above Gowanda | At southeast side of Gowanda, 0.1 mile downstream from Point Peter Brook | b/July 5, 1963 | 1030 | 24 | 7.4 | 159 | 339 | 7.6 |
| E23(17.4) | Cattaraugus Creek | At Gowanda | At bridge on Rt. 39, at gaging station. | a,b,c,d/July 26, 1962<br>July 5, 1963 | 1215<br>0930 | --<br>41 | 32<br>37 | 173<br>177 | 476<br>462 | 7.3<br>7.1 |
| E23-6-4(0.6) | North Branch Clear Creek | Near Lawtons | At bridge on Taylor Hollow Rd. | July 2, 1963 | 1600 | -- | -- | -- | 369 | 8.3 |
| E23-6(0.9) | Clear Creek | Near Iroquois | At water discharge partial-record station at bridge on Rt. 438. | b/July 2, 1963 | 1430 | 54 | 11 | 204 | 429 | 7.8 |
| E23-5(1.8) | Big Indian Creek | Near Versailles | At bridge on Watertown Rd. | July 2, 1963 | 1320 | 109 | 39 | 136 | 416 | 6.9 |
| E23(1.6) | Cattaraugus Creek | At Irving | At bridge on Rt. 20 | July 5, 1963<br>July 12 | 1300<br>0850 | 39<br>-- | 18<br>-- | 184<br>-- | 407<br>409 | 7.4<br>7.7 |
| E23(0.0) | Cattaraugus Creek | Near Irving | At mouth. | e/Aug. 27, 1957 | 0900 | -- | 13 | 194 | 398 | 7.8 |
| E21(1.5) | Delaware Creek | Near Angola | At bridge on Rt. 5. | a/July 2, 1963 | 1120 | 45 | 24 | 173 | 403 | 7.7 |
| E20-2(0.8) | Rythus Creek | Near Pontiac | At bridge on Pontiac Rd. | July 2, 1963 | 1000 | 48 | 39 | 173 | 439 | 7.7 |
| E20(2.2) | Big Sister Creek | At Evans Center | At water discharge partial-record station, at bridge on Rt. 5. | a,b/July 2, 1963 | 1030 | 60 | 99 | 141 | 675 | 7.1 |
| E15(0.5) | Pike Creek | Near Highland-on-the-Lake | At bridge on Lake Shore Rd. | July 2, 1963 | 0850 | -- | -- | -- | 614 | 7.5 |
| E13(25.5) | Eighteenmile Creek | Near Fowlerville | On Rt. 219, 0.5 mile southeast of Snyder Rd. | July 4, 1963<br>July 12 | 1445<br>1152 | 36<br>-- | 6.3<br>-- | 183<br>-- | 361<br>381 | 8.1<br>8.3 |
| E13(22.8) | do. | At Fowlerville | At bridge on Fowler Rd., 0.1 mile west of Rt. 219. | a/July 4, 1963 | 1525 | 57 | 15 | 196 | 423 | 7.4 |
| E13(20.6) | do. | At Boston | At bridge on Pfarner Rd. | July 4, 1963 | 0845 | -- | -- | -- | 419 | 8.1 |
| E13(15.3) | do. | At North Boston | At gaging station, at bridge on Zimmerman Rd. | a,b/July 2, 1963 | 1330 | 43 | 19 | 168 | 387 | 7.6 |
| E13-9(0.1) | Chestnut Ridge Drainage | Near North Boston | At bridge on Rt. 219. | July 4, 1963 | 0840 | 74 | 17 | 244 | 507 | 7.7 |
| E13-8(0.3) | Neuman Creek | At Hamburg | do. | July 4, 1963 | 0800 | -- | -- | -- | 599 | 7.0 |
| E13-6(1.3) | Hampton Brook | Near Hamburg | At intersection of E. Eden Rd. and Ekhard Rd. | July 2, 1963 | -- | -- | -- | -- | 374 | 7.5 |
| E13-4(15.5) | South Branch Eighteenmile Creek | At New Oregon | On New Oregon Rd. | July 2, 1963 | 1400 | -- | -- | -- | 329 | 8.0 |
| E13-4(11.0) | do. | At Clarksburg | At bridge on New Oregon Rd., north of Clarksburg. | July 2, 1963 | 1300 | -- | -- | -- | 367 | 7.5 |
| E13-4(2.9) | do. | At Eden Valley | At water discharge partial-record station, at bridge 300 ft upstream from Rt. 62. | a,b/July 2, 1963 | 1115 | 55 | 13 | 165 | 379 | 7.7 |

a/ Additional analyses included in table 17.
b/ Additional analyses included in table 19.
c/ Additional analyses included in table 20.
d/ Bicarbonate ($HCO_3$) 172 ppm.
e/ Bicarbonate ($HCO_3$) 194 ppm, Nitrate ($NO_3$) 9.3 ppm.

## Table 18.--Chemical analyses of streams at low flow (Continued)

| Sampling point mileage index number | Stream | Location | Point of collection | Date of collection | Time (hours) | Sulfate ($SO_4$) (ppm) | Chloride (Cl) (ppm) | Hardness as $CaCO_3$ (ppm) | Specific conductance (micromhos at 25°C) | pH |
|---|---|---|---|---|---|---|---|---|---|---|
| E13(0.5) | Eighteenmile Creek | At Highland-on-the-Lake | At water discharge partial-record station, at bridge on Lake Shore Rd. | b/July 2, 1963 | 0840 | 70 | 80 | 215 | 629 | 7.3 |
| E2-2(0.6) | Tributary to Smoke Creek | Near Orchard Park | At bridge on Mile Strip Rd. | July 4, 1963 | 1705 | 101 | 36 | 296 | 649 | 7.8 |
| E2-1(4.5) | South Branch Smoke Creek | do. | At bridge on Rt. 20. | July 2, 1963<br>July 4 | 1350<br>0700 | 55<br>63 | 74<br>67 | 183<br>243 | 579<br>694 | 9.4<br>7.5 |
| E2(3.5) | Smoke Creek | At Lackawanna | At bridge on Abbott Rd. | a/July 2, 1963 | 1250 | 79 | 53 | 244 | 623 | 7.4 |
| E1(42.2) | Buffalo Creek | Near Java Village | At bridge on Sheehe Rd., at intersection of Whaley Rd. | July 5, 1963 | 1420 | 184 | 27 | 260 | 533 | 6.2 |
| E1-59(0.3) | Plato Brook | do. | 150 ft above pond off Michigan Rd., 0.3 mile upstream from mouth. | May 5, 1964<br>July 22<br>Sept.10 | 1525<br>0825<br>1250 | 37<br>41<br>46 | 4.6<br>5.0<br>9.7 | 152<br>240<br>244 | 315<br>471<br>492 | 8.2<br>8.0<br>7.8 |
| E1-58(0.0) | Tributary to Buffalo Creek | At Java Village | At bridge on Michigan Rd. | July 5, 1963 | 1330 | 36 | 34 | 210 | 429 | 7.4 |
| E1-55(3.2) | Beaver Meadow Creek | Near Java Center | At bridge on Cattaraugus Rd. | July 4, 1963 | 1720 | 66 | 20 | 184 | 384 | 7.0 |
| E1-55-1(0.8) | Tributary to Beaver Meadow Creek | do. | At bridge on Welch Rd., 0.15 mile east of McNulty Rd. | July 4, 1963 | 1625 | 66 | 58 | 184 | 417 | 6.5 |
| E1-55(0.1) | Beaver Meadow Creek | At Java Village | At bridge on Rt. 78. | b/July 4, 1963 | 1500 | 21 | 6.0 | 156 | 305 | 8.0 |
| E1(40.9) | Buffalo Creek | do. | At bridge on Whitney Rd. | b/July 5, 1963 | 1215 | 33 | 6.0 | 177 | 356 | 7.8 |
| E1-45(0.6) | Glade Creek | At Strykersville | At bridge on Rt. 78. | July 4, 1963 | 1340 | 71 | 20 | 180 | 400 | 7.5 |
| E1-40(2.7) | Sheldon Creek | At Dutch Hollow | At bridge on Center Line Rd. | July 5, 1963 | 1035 | 67 | 26 | 121 | 310 | 6.5 |
| E1-40(0.2) | do. | Near Strykersville | At bridge on Rt. 78. | July 4, 1963 | 1300 | -- | -- | -- | 314 | 7.8 |
| E1(31.8) | Buffalo Creek | Near Wales Hollow | At gaging station, at bridge on Marlou Rd. | a,b/July 2, 1963 | 1240 | 41 | 10 | 190 | 393 | 7.4 |
| E1-31(0.1) | Stony Bottom Creek | Near Wales Center | At culvert on Rt. 78. | July 5, 1963 | 0830 | -- | -- | -- | 360 | 7.9 |
| E1-30(9.8) | Hunter Creek | Near Holland | At bridge on Sanders Rd. | July 2, 1963 | 1055 | 80 | 12 | 231 | 470 | 7.9 |
| E1-30(3.7) | do. | At Colegrave | At bridge on Center Line Rd. | a/July 2, 1963 | 1420 | -- | -- | -- | 499 | 7.4 |
| E1-22(0.2) | Tributary to Buffalo Creek | Near East Aurora | At culvert on West Blood Rd., 2,200 ft east of Ostrander Rd. | July 4, 1963 | 1210 | 165 | 33 | 367 | 727 | 6.9 |
| E1-21(0.5) | do. | do. | On West Blood Rd., 800 ft east of Ostrander Rd. | July 4, 1963<br>May 18, 1964<br>July 22<br>Sept. 8 | 1135<br>1545<br>1202<br>1435 | --<br>33<br>30<br>36 | --<br>15<br>18<br>18 | --<br>251<br>258<br>268 | 504<br>494<br>499<br>525 | 7.3<br>8.0<br>8.4<br>8.1 |
| E1-15(4.1) | Pond Brook | do. | At bridge on Jamison Rd. | July 4, 1963 | 1045 | 64 | 27 | 231 | 491 | 6.9 |
| E1-15(0.0) | do. | At Elma | At bridge on Chair Factory Rd., East of Bowen Rd. | July 4, 1963<br>July 12 | 1325<br>1425 | --<br>-- | --<br>-- | --<br>-- | 413<br>433 | 8.6<br>9.5 |
| E1(18.0) | Buffalo Creek | do. | At bridge on Bowen Rd. | b/July 5, 1963<br>July 12 | 1320<br>1452 | 53<br>-- | 12<br>-- | 173<br>-- | 378<br>390 | 7.5<br>8.2 |
| E1(13.8) | do. | At Blossom | At bridge on Blossom Rd. | July 4, 1963 | 1440 | -- | -- | -- | 363 | 8.6 |
| E1(10.4) | do. | At Gardenville | At bridge on Union Rd., 700 ft upstream from gaging station. | a,b/July 5, 1963 | 1030 | 55 | 12 | 163 | 359 | 7.4 |
| E1-6(30.6) | Cayuga Creek | Near Persons Corners | At bridge on Rt. 77 | July 5, 1963 | 0915 | -- | -- | -- | 353 | 8.2 |

a/ Additional analyses included in table 17.
b/ Additional analyses included in table 19.

## Table 18.--Chemical analyses of streams at low flow (Continued)

| Sampling point mileage index number | Stream | Location | Point of collection | Date of collection | Time (hours) | Sulfate ($SO_4$) (ppm) | Chloride (Cl) (ppm) | Hardness as $CaCO_3$ (ppm) | Specific conductance (micromhos at 25°C) | pH |
|---|---|---|---|---|---|---|---|---|---|---|
| E1-6-30(2.2) | Right Branch Cayuga Creek | At Bennington | At bridge on Rt. 77 | July 5, 1963<br>July 12 | 1000.<br>-- | --<br>-- | --<br>-- | --<br>-- | 341<br>761 | 7.8<br>7.7 |
| E1-6(23.3) | Cayuga Creek | At Cowlesville | At bridge on Urf Rd. | b/July 5, 1963 | 1415 | 48 | 24 | 190 | 423 | 7.8 |
| E1-6(20.9) | do. | Near Williston | At bridge on Rt. 354 (Clinton Rd.) above waste disposal outlet. | July 4, 1963 | 1050 | -- | -- | -- | 401 | 8.0 |
| E1-6(20.9) | do. | do. | At bridge on Rt. 354 (Clinton Rd.) below waste disposal outlet. | July 4, 1963 | 1045 | -- | -- | -- | 390 | 8.0 |
| E1-6-20(2.6) | Tributary to Cayuga Creek | Near Cowlesville | At bridge on County Line Rd. | July 5, 1963 | 1230 | 37 | 18 | 82 | 232 | 7.2 |
| E1-6-20(0.7) | do. | do. | At bridge on Rt. 239. | July 5, 1963 | 1045 | -- | -- | -- | 357 | 7.3 |
| E1-6-7(9.3) | Little Buffalo Creek | At Marilla | At bridge on Marilla-Williston Rd. | July 4, 1963 | 0845 | 37 | 30 | 160 | 362 | 7.5 |
| E1-6-7-10(0.1) | Tributary to Little Buffalo Creek | do. | At mouth, off Bullis Rd., northeast of Marilla. | July 4, 1963 | 1000 | 74 | 11 | 255 | 503 | 7.9 |
| E1-6-7-7(0.2) | do. | Near Marilla | At culvert on Bullis Rd., at intersection with Town Line Rd. | a/July 4, 1963 | 0955 | -- | -- | -- | 351 | 8.0 |
| E1-6(11.0) | Cayuga Creek | Near Lancaster | At bridge on Bowen Rd., 700 ft upstream from gaging station. | b/July 5, 1963 | 1420 | 52 | 13 | 168 | 375 | 7.6 |
| E1-6-6(0.5) | Plum Bottom Creek | At Lancaster | At bridge on Holland Avenue. | July 5, 1963<br>July 12 | 1005<br>1536 | 53<br>-- | 320<br>-- | 265<br>-- | 1,420<br>1,180 | 7.7<br>7.7 |
| E1-4-15-22-3(0.1) | Tributary to Spencer Brook | Near Scotts Corners | At bridge on Allen Rd. | July 4, 1963 | 1010 | 78 | 15 | 104 | 399 | 7.8 |
| E1-4-15(15.3) | West Branch Cazenovia Creek | At Footes | At bridge off Rt. 240, 0.2 mile south of Footes Rd. | a/July 4, 1963 | 1355 | -- | -- | -- | 329 | 7.6 |
| E1-4-15-21(0.0) | Sprague Brook | Near Glenwood | At bridge on Rt. 240. | July 4, 1963<br>July 12 | 1335<br>0938 | --<br>-- | --<br>-- | --<br>-- | 347<br>366 | 8.1<br>8.2 |
| E1-4-15(10.5) | West Branch Cazenovia Creek | At Colden | At upstream bridge on Rt. 240. | July 4, 1963<br>July 12 | 1005<br>1042 | 49<br>-- | 9.1<br>-- | 140<br>-- | 377<br>476 | 8.0<br>7.6 |
| E1-4-15(5.4) | do. | At West Falls | 1,400 ft upstream from bridge in West Falls. | July 4, 1963 | 1125 | -- | -- | -- | 366 | 8.7 |
| E1-4-15-4(0.2) | Tributary to West Branch Cazenovia Creek | At Taylorshire | At bridge on Grover Rd. | July 2, 1963 | 1215 | -- | -- | -- | 685 | 7.7 |
| E1-4-15(0.5) | West Branch Cazenovia Creek | Near East Aurora | At water discharge partial-record station, at bridge on Jewett-Holmwood Rd. | b/July 5, 1963 | 1110 | 60 | 14 | 160 | 352 | 7.6 |
| E1-4-14(13.6) | East Branch Cazenovia Creek | At Holland | At bridge on Rt. 16. | July 2, 1963 | 0945 | 37 | 13 | 183 | 380 | 8.0 |
| E1-4-14-20(0.2) | Tributary to East Branch Cazenovia Creek | do | At bridge on Rt. 16, near Partridge Rd. | July 2, 1963 | 0845 | 51 | 2.8 | 148 | 303 | 8.2 |
| E1-4-14(8.1) | East Branch Cazenovia Creek | At South Wales | At water discharge partial-record station, at bridge on Darling Rd. | a,b/July 2, 1963 | 0730 | 38 | 12 | 146 | 330 | 7.3 |
| E1-4-14-4(2.0) | Tannery Brook | At East Aurora | At bridge on Rt. 20A. | July 2, 1963 | 1530 | 53 | 78 | 253 | 757 | 7.2 |

a/ Additional analyses included in table 17.
b/ Additional analyses included in table 19.

# Table 18.--Chemical analyses of streams at low flow (Continued)

| Sampling point mileage index number | Stream | Location | Point of collection | Date of collection | Time (hours) | Sulfate ($SO_4$) (ppm) | Chloride (Cl) (ppm) | Hardness as $CaCO_3$ (ppm) | Specific conductance (micromhos at 25°C) | pH |
|---|---|---|---|---|---|---|---|---|---|---|
| E1-4(10.4) | Cazenovia Creek | At Spring Brook | At bridge on Northrup Rd. | July 4, 1963 | 1600 | -- | -- | -- | 488 | 9.2 |
| | | | | July 12 | -- | -- | -- | -- | 654 | 9.3 |
| E1-4(4.1) | do. | At Ebenezer | At gaging station on Ridge Rd. | a,b/July 2, 1963 | 1515 | 69 | 48 | 190 | 491 | 8.8 |
| | | | | July 5 | 1250 | 58 | 51 | 196 | 497 | 8.9 |
| 0158-15(11.6) | Scajaquada Creek | At Lancaster | At bridge on Leyard Ave., between NYC and Lehigh RR. tracks. | July 5, 1963 | 0930 | -- | -- | -- | 575 | 7.4 |
| 0158-12(100.6) | Tonawanda Creek | Near Johnsonburg | At water discharge partial-record station, at bridge on Rt. 98. | a,b/July 2, 1963 | 1310 | 27 | 5.8 | 171 | 338 | 8.1 |
| 0158-12-66(0.1) | Stony Brook | At Varysburg | At bridge on Rt. 20A. | a/July 4, 1963 | 1435 | 316 | 34 | 130 | 1,210 | 2.9 |
| | | | | July 12 | 1605 | 42 | 12 | 171 | 364 | 8.3 |
| 0158-12-59(0.2) | Johnson Creek | At Earls | At bridge on Eck Rd. | July 5, 1963 | 0935 | 108 | 54 | 221 | 489 | 6.6 |
| 0158-12-41(0.1) | Tannery Brook | At Attica | At bridge on Rt. 98. | a/July 2, 1963 | 1645 | -- | -- | -- | 604 | 6.7 |
| 0158-12-39-3(0.2) | Baker Brook | do. | At bridge on Rt. 238 | July 4, 1963 | 1635 | 60 | 52 | 328 | 659 | 6.8 |
| 0158-12-39-1(0.1) | Tributary to Tonawanda Creek | Near Attica | At bridge, near Attica Rd., east side of Tonawanda Creek, 600 ft south of Stroh Rd. | July 2, 1963 | 1530 | -- | -- | -- | 599 | -- |
| 0158-12(85.6) | Tonawanda Creek | do. | At bridge on Stroh Rd. | b/July 2, 1963 | 1450 | 40 | 10 | 197 | 411 | 7.3 |
| 0.58-12-35(0.6) | Tributary to Tonawanda Creek | At Alexander | At bridge on Brookville Rd. | July 2, 1963 | 1010 | 23 | 9.0 | 270 | 515 | 7.6 |
| 0158-12-32(15.2) | Little Tonawanda Creek | At Dale | At bridge on Fox Rd. | July 2, 1963 | 1150 | 25 | 6.2 | 174 | 350 | 7.7 |
| 0158-12-32-8(0.7) | Middlebury Brook | At West Middlebury | At bridge on West Middlebury Rd. | July 2, 1963 | 1115 | -- | -- | -- | 429 | 8.0 |
| 0158-12-32(9.4) | Little Tonawanda Creek | At Linden | At gaging station at bridge in Linden | a,b/July 2, 1963 | 1100 | 33 | 6.4 | 201 | 420 | 7.9 |
| 0158-12-32(5.3) | do. | At West Bethany | At bridge on Gilhodly Rd. | July 2, 1963 | 0935 | -- | -- | -- | 444 | 8.0 |
| 0158-12-32(4.1) | do. | At East Alexander | At bridge on Creek Rd. | July 2, 1963 | -- | 38 | 11 | 190 | 386 | 7.8 |
| 0158-12-32(1.1) | do. | Near East Alexander | At bridge on Old Creek Rd. | July 2, 1963 | 0830 | -- | -- | -- | 419 | 7.5 |
| 0158-12(69.2) | Tonawanda Creek | At Batavia | At gaging station, 500 ft upstream from bridge on Walnut St. | a,b/July 2, 1963 | 0740 | 41 | 12 | 187 | 404 | 7.5 |
| 0158-12-28(11.4) | Bowen Creek | Near Alexander | At bridge on Rt. 20. | July 2, 1963 | 1310 | -- | -- | -- | 1,300 | 7.1 |
| 0158-12-28(8.0) | do. | do. | At bridge on Dodgeson Rd. | July 2, 1963 | 1100 | 91 | 44 | 349 | 714 | 7.5 |
| 0158-12(54.1) | Tonawanda Creek | At Indian Falls | At bridge on Rt. 77. | b/July 2, 1963 | -- | 43 | 37 | 238 | 560 | 7.6 |
| 0158-12(46.9) | do. | Near Alabama | At gaging station, at bridge on Meadville Rd. | a,b/July 2, 1963 | 1015 | 84 | 46 | 282 | 670 | 7.6 |
| 0158-12-14(0.5) | Tributary to Tonawanda Creek | Near Swifts Mills | At bridge on Brunning Rd., 0.2 mile west of Scotland. | a/July 2, 1963 | 0930 | 1,020 | 359 | 1,360 | 3,020 | 7.6 |
| 0158-12-11-1(29.5) | Murder Creek | At Darien | At bridge on Griswold Rd., 0.2 mile south of Rt. 238. | a/July 2, 1963 | 1220 | 61 | 26 | 153 | 370 | 7.3 |
| 0158-12-11-1(26.9) | do. | At Sawens | At bridge on Harper Rd. | July 2, 1963 | 1145 | 43 | 45 | 199 | 496 | 7.8 |
| 0158-12-11-1(15.1) | do. | Near Pembroke | At bridge on Cohocton Rd. | July 2, 1963 | 1415 | -- | -- | -- | 604 | 7.7 |

a/ Additional analyses included in table 17.
b/ Additional analyses included in table 19.

## Table 18.--Chemical analyses of streams at low flow (Continued)

| Sampling point mileage index number | Stream | Location | Point of collection | Date of collection | Time (hours) | Sulfate ($SO_4$) (ppm) | Chloride (Cl) (ppm) | Hardness as $CaCO_3$ (ppm) | Specific conductance (micromhos at 25°C) | pH |
|---|---|---|---|---|---|---|---|---|---|---|
| 0158-12-11-1(13.0) | Murder Creek | At Pembroke | At water discharge partial-record station, at bridge on Lake Rd. | b/July 2, 1963 | 1330 | 29 | 71 | 300 | 697 | 7.4 |
| 0158-12-11-1(8.4) | do. | At Akron | In village park. | July 2, 1963 | 0840 | 100 | 74 | 397 | 795 | 7.5 |
| 0158-12-11-1-1(0.8) | Beaver Meadow Creek | At Swifts Mills | At bridge on Greenbush Rd. | July 5, 1963 | 0815 | 1,190 | 20 | 1,410 | 2,070 | 7.8 |
| 0158-12-9(1.2) | Beeman Creek | Near Hunts Corner | On Rt. 268 at Cedar Swamp Rd. | July 5, 1963 | 0800 | 888 | 22 | 1,170 | 1,780 | 7.5 |
| 0158-12(19.5) | Tonawanda Creek | At Rapids | At gaging station, at highway bridge, at Rapids. | a,b/July 2, 1963 | 0930 | 240 | 48 | 455 | 950 | 7.4 |
| 0158-12-8(15.1) | Mud Creek | At Wolcottsville | At bridge on Wolcottsville Rd., 0.5 mile north of Wolcottsville. | a/May 6, 1964 | 1250 | 89 | 14 | 270 | 529 | 7.3 |
| 0158-12-8(0.5) | do. | At Millersport | At bridge on Rt. 78. | July 2, 1963 | 1100 | -- | -- | -- | 562 | 7.7 |
| 0158-12-6-4(3.5) | Got Creek | Near East Amherst | At bridge on Newhouse Rd. | July 2, 1963 | 1340 | 1,240 | 56 | 1,530 | 2,360 | 7.1 |
| 0158-12-6-3(1.1) | Black Creek | At Swormville | At bridge on Rt. 78. | July 2, 1963 | 1135 | -- | -- | -- | 1,660 | 7.5 |
| 0158-12-6(2.5) | Ransom Creek | Near Swormville | At bridge on Rt. 263. | b/July 2, 1963 | 1155 | 1,200 | 107 | 1,470 | 2,360 | 7.2 |
| | | | | June 26, 1964 | 1315 | 1,100 | 34 | 1,270 | 1,940 | 8.1 |
| | | | | Sept. 21 | 0900 | 1,250 | 81 | 1,500 | 2,340 | 7.5 |
| 0158-12-5(0.0) | Tributary to Tonawanda Creek | At Wendelville | At mouth of stream, 0.9 mile east of Wendelville. | July 2, 1963 | 0930 | 58 | 28 | 132 | 342 | 7.6 |
| 0158-12-3-3(0.9) | Tributary to Bull Creek | At Mapleton | At bridge on Mapleton Rd., 0.6 mile west of Aiken Rd. | a/July 2, 1963 | 1100 | 190 | 31 | 450 | 860 | 8.0 |
| 0158-12-3(1.4) | Bull Creek | At Hoffman | At bridge on Town Line Rd., 1 mile south of Killean Rd. | a,b/July 2, 1963 | 1015 | 183 | 54 | 448 | 936 | 7.5 |
| | | | | May 6, 1964 | 0930 | 135 | 31 | 332 | 645 | 7.2 |
| | | | | July 23 | 1143 | 136 | 42 | 365 | 795 | 7.3 |
| | | | | Sept. 8 | 0840 | 132 | 35 | 351 | 746 | 7.0 |
| 0158-12-1(43.1) | Elevenmile Creek | Near Darien Center | On Rt. 20, 0.5 mile east of Harlow Rd., 1.8 miles west of Darien Center | a/May 18, 1964 | 1435 | 34 | 9.1 | 102 | 239 | 7.2 |
| | | | | July 27 | 1256 | 48 | 52 | 184 | 508 | 7.5 |
| | | | | Sept. 8 | 1246 | 67 | 74 | 180 | 573 | 8.1 |
| 0158-12-1(41.4) | do. | Near Fargo | At bridge on Sumner Rd. | July 2, 1963 | 1530 | 63 | 53 | 260 | 621 | 8.2 |
| 0158-12-1(39.9) | Ellicott Creek | Near Crittenden | At bridge on Harlow Rd. | July 2, 1963 | 1500 | 37 | 34 | 165 | 399 | 7.8 |
| 0158-12-1(35.3) | do. | At Alden | At bridge on Alden Station Rd. | July 2, 1963 | 1615 | 19 | 53 | 163 | 409 | 7.5 |
| 0158-12-1-18(0.4) | Spring Creek | do. | do. | July 2, 1963 | 1645 | 38 | 9.8 | 240 | 471 | 7.5 |
| 0158-12-1(28.8) | Ellicott Creek | At Mill Grove | At bridge on Ellicott Rd., at gaging station. | b/July 5, 1963 | 1125 | 82 | 86 | 261 | 763 | 7.5 |
| 0158-12-1-16(0.4) | Tributary to Ellicott Creek | do. | At bridge on North Millgrove Rd., 0.3 mile north of Rt. 33. | July 5, 1963 | 0750 | 98 | 155 | 294 | 1,010 | 7.8 |
| | | | | May 6, 1964 | 1145 | 36 | 60 | 243 | 624 | 7.4 |
| | | | | Sept. 12 | 0935 | 47 | 177 | 230 | 924 | 7.2 |
| 0158-12-1(14.1) | Ellicott Creek | At Williamsville | At gaging station, at bridge on Wehrle Dr. | a,b/July 2, 1963 | 1550 | 353 | 57 | 486 | 1,020 | 7.9 |
| | | | | July 5 | 1540 | 136 | 56 | 289 | 712 | 8.1 |

a/ Additional analyses included in table 17.
b/ Additional analyses included in table 19.

# Table 19.--Chemical analyses of major streams and tributaries

Remarks.--Sampling point mileage index number precedes the stream name and location followed by U.S. Geological Survey station number (where used) and the point of collection. Additional analyses for some sampling sites are included in tables 17, 18, 20, 21, and are indicated by footnotes in the date of collection column.

(All results in parts per million, except specific conductance, pH, color, and turbidity)

| Date of collection | Time (hours) | Instantaneous discharge (cfs) | Percent of time flow exceeded that listed | Silica ($SiO_2$) | Iron (Fe) | Manganese (Mn) | Calcium (Ca) | Magnesium (Mg) | Sodium (Na) | Potassium (K) | Bicarbonate ($HCO_3$) | Sulfate ($SO_4$) | Chloride (Cl) | Fluoride (F) | Nitrate ($NO_3$) | Dissolved solids at 180°C | Hardness as $CaCO_3$: Calcium, magnesium | Hardness as $CaCO_3$: Non-carbonate | Specific conductance (micromhos at 25°C) | pH | Color | Alkyl benzene sulfonate (ABS) | Turbidity |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| E23(56.7) Cattaraugus Creek at Arcade, at bridge on Rt. 98, 0.1 mile upstream from Clear Creek. | | | | | | | | | | | | | | | | | | | | | | | |
| Apr. 17, 1963 | 0900 | 42 | -- | 1.8 | 0.03 | 0.00 | 42 | 5.5 | 3.3 | 1.0 | 124 | 20 | 7.4 | 0.1 | 2.6 | 156 | 128 | 26 | 259 | 8.0 | 6 | 0.0 | 0.4 |
| May 7 | 0800 | 29 | -- | 1.5 | .02 | .01 | 45 | 7.6 | 3.0 | 1.0 | 143 | 20 | 7.8 | .1 | 2.3 | 166 | 144 | 27 | 288 | 7.8 | 5 | .0 | .4 |
| July 2 | 1530 | 14 | -- | 3.2 | .01 | .03 | 43 | 6.9 | 4.1 | 1.4 | 143 | 17 | 8.8 | .1 | 1.5 | 165 | 136 | 19 | 288 | 8.1 | 5 | .0 | .3 |
| E23(54.7) Cattaragus Creek near Arcade, 2134.1 at gaging station, at bridge on North Woods Rd. | | | | | | | | | | | | | | | | | | | | | | | |
| a/Apr. 17, 1963 | 1020 | 102 | 32 | 2.8 | .01 | .01 | 42 | 5.6 | 4.1 | 1.2 | 125 | 18 | 8.0 | .1 | 5.2 | 162 | 128 | 26 | 278 | 7.7 | 4 | .0 | .4 |
| May 7 | 0815 | 70 | 42 | 1.7 | .03 | .01 | 44 | 7.4 | 3.9 | 1.1 | 140 | 18 | 8.8 | .2 | 3.4 | 172 | 141 | 26 | 288 | 7.9 | 4 | .0 | .5 |
| July 2 | 1605 | 30 | 74 | 2.8 | .02 | .01 | 44 | 6.7 | 6.0 | 1.8 | 145 | 18 | 9.7 | .1 | 2.3 | 170 | 138 | 19 | 295 | 8.0 | 4 | .1 | .0 |
| E23-48(0.6) Elton Creek At The Forks, 2134.2 at water discharge partial-record station, at bridge on Creek Rd. | | | | | | | | | | | | | | | | | | | | | | | |
| a/Apr. 17, 1963 | 0950 | 94 | -- | 3.3 | .04 | .01 | 43 | 5.5 | 3.2 | 1.0 | 127 | 23 | 5.5 | .1 | 3.6 | 157 | 139 | 26 | 272 | 8.1 | 6 | .0 | .6 |
| May 7 | 0840 | 72 | -- | 2.3 | .05 | .01 | 44 | 7.2 | 2.8 | .8 | 140 | 22 | 6.0 | .3 | 2.3 | 162 | 140 | 25 | 282 | 7.8 | 3 | .0 | .3 |
| July 5 | 1325 | 35 | -- | 4.2 | .03 | .00 | 44 | 7.0 | 3.4 | 1.0 | 143 | 25 | 5.6 | .1 | 1.2 | 168 | 139 | 22 | 316 | 7.8 | 4 | .0 | .3 |
| E23-33(5.0) Buttermilk Creek near Riceville Station, at bridge on Fox Valley Rd. | | | | | | | | | | | | | | | | | | | | | | | |
| b/May 18, 1962 | -- | -- | -- | 2.4 | -- | -- | 35 | 4.1 | 3.8 | 1.5 | 98 | 25 | 6.0 | .0 | .0 | 128 | 105 | 24 | 226 | 7.8 | 3 | -- | 2 |
| E23-33(1.5) Buttermilk Creek near Springville, 2134.50, at gaging station, at bridge on Hayes Hollow Rd. | | | | | | | | | | | | | | | | | | | | | | | |
| b/May 18, 1962 | -- | -- | -- | 2.6 | -- | -- | 38 | 5.1 | 3.0 | 1.4 | 110 | 29 | 4.0 | .0 | .0 | 144 | 116 | 26 | 245 | 8.0 | 3 | -- | 2 |
| Oct. 8 | 1510 | -- | -- | 3.8 | .04 | .03 | 49 | 7.3 | 6.0 | 1.5 | 140 | 47 | 5.0 | .2 | .4 | 199 | 153 | 38 | 334 | 8.1 | 3 | -- | .6 |
| Feb. 4, 1963 | 1310 | -- | -- | 3.9 | .01 | .03 | 34 | 4.0 | 4.1 | .9 | 93 | 28 | 5.8 | .1 | 2.0 | 135 | 102 | 26 | 233 | 7.6 | 2 | -- | .7 |
| May 7 | 1555 | 18 | 53 | 2.1 | .05 | .01 | 32 | 4.5 | 3.2 | 1.5 | 95 | 25 | 4.0 | .2 | .1 | 130 | 99 | 21 | 216 | 7.8 | 4 | -- | .7 |
| E23(26.9) Cattaraugus Creek at Zoar Bridge near Gowanda, 2134.7 at bridge on road to Otto off Zoar Valley Rd. | | | | | | | | | | | | | | | | | | | | | | | |
| Apr. 17, 1963 | 1145 | c/500 | -- | 3.4 | .07 | .01 | 48 | 6.3 | 3.8 | 1.2 | 136 | 28 | 7.7 | .2 | 5.7 | 180 | 146 | 35 | 302 | 7.8 | 5 | .0 | .8 |
| May 7 | 0920 | 307 | -- | 1.6 | .03 | .01 | 46 | 7.9 | 3.6 | 1.3 | 140 | 29 | 8.0 | .0 | 2.9 | 184 | 148 | 33 | 311 | 7.9 | 4 | .0 | .8 |
| July 5 | 1700 | 110 | -- | 3.3 | .05 | .01 | 51 | 8.0 | 5.0 | 1.6 | 157 | 32 | 10 | .1 | 1.9 | 206 | 160 | 32 | 339 | 7.8 | 4 | .0 | .3 |
| E23-20(14.4) South Branch Cattaraugus Creek near Otto, 2134.9, at water discharge partial-record station, 0.2 mile upstream from Mansfield Creek. | | | | | | | | | | | | | | | | | | | | | | | |
| a/Apr. 17, 1963 | 1220 | 25 | -- | 2.1 | .04 | .00 | 31 | 2.6 | 3.2 | 1.3 | 80 | 20 | 6.1 | .1 | 2.0 | 114 | 88 | 23 | 194 | 7.7 | 5 | .0 | .3 |
| May 7 | 1000 | 19 | -- | 1.2 | .05 | .00 | 32 | 4.9 | 3.2 | 1.3 | 97 | 20 | 6.8 | .1 | 1.3 | 123 | 100 | 21 | 215 | 7.6 | 6 | .0 | .4 |
| July 5 | 1430 | 2.8 | -- | 4.1 | .03 | .01 | 53 | 6.3 | 4.9 | 1.8 | 163 | 27 | 9.0 | .1 | .9 | 201 | 158 | 25 | 336 | 7.4 | 3 | .0 | .6 |
| E23(19.4) Cattaraugus Creek above Gowanda, 2134.98 at southeast side of Gowanda, 0.1 mile downstream from Point Peter Brook. | | | | | | | | | | | | | | | | | | | | | | | |
| Apr. 17, 1963 | 1410 | -- | -- | 3.6 | .87 | .02 | 45 | 6.0 | 4.1 | 1.3 | 122 | 29 | 7.8 | .1 | 4.8 | 177 | 137 | 37 | 296 | 7.6 | 4 | .0 | .4 |
| May 7 | 1050 | -- | -- | 1.4 | .04 | .01 | 45 | 8.0 | 3.7 | 1.2 | 135 | 30 | 7.3 | .1 | 2.5 | 174 | 146 | 35 | 299 | 7.9 | 4 | .0 | .4 |
| July 5 | 1030 | -- | -- | 4.8 | .04 | .00 | 51 | 7.8 | 5.0 | 1.6 | 159 | 24 | 7.4 | .0 | 1.8 | 201 | 159 | 29 | 339 | 7.6 | 3 | .0 | .5 |
| E23(17.4) Cattaraugus Creek at Gowanda, 2135 at bridge on Rt. 39, at gaging station. | | | | | | | | | | | | | | | | | | | | | | | |
| a,b,d/Aug. 13, 1956 | 1730 | 223 | 67 | 6.0 | .07 | .00 | 70 | 8.8 | 18 | 1.9 | 173 | 54 | 25 | .0 | 25 | 307 | 211 | 69 | 503 | 6.9 | 5 | -- | -- |
| Apr. 17, 1963 | 1600 | 539 | 35 | 3.2 | .05 | .00 | 50 | 6.2 | 6.3 | 1.2 | 134 | 33 | 11 | .1 | 7.9 | 193 | 151 | 41 | 330 | 7.3 | 7 | .0 | .6 |
| May 7 | 1110 | 370 | 48 | 1.7 | .03 | .00 | 52 | 9.2 | 16 | .8 | 135 | 46 | 25 | .1 | 11 | 233 | 168 | 57 | 423 | 6.9 | 4 | .0 | .0 |
| July 5 | 0930 | 135 | 84 | 3.4 | .03 | .00 | 57 | 8.4 | 24 | 1.8 | 162 | 41 | 37 | .0 | 6.9 | 287 | 177 | 44 | 462 | 7.1 | 6 | .1 | .6 |
| E23-6(0.9) Clear Creek near Iroquois, 2140.1 at water discharge partial-record station, at bridge on Rt. 438. | | | | | | | | | | | | | | | | | | | | | | | |
| Apr. 17, 1963 | 1630 | 27 | -- | 3.0 | .06 | .01 | 53 | 8.3 | 6.4 | 2.0 | 128 | 55 | 11 | .1 | 2.9 | 221 | 166 | 61 | 366 | 7.6 | 5 | .0 | .0 |
| May 7 | 1145 | 23 | -- | 2.3 | .05 | .01 | 51 | 10 | 6.4 | 1.8 | 134 | 54 | 10 | .1 | .6 | 205 | 168 | 58 | 362 | 7.8 | 3 | .0 | .0 |
| July 2 | 1430 | 3.5 | -- | 5.9 | .05 | .05 | 62 | 12 | 7.6 | 2.4 | 184 | 54 | 11 | .2 | .7 | 257 | 204 | 53 | 429 | 7.8 | 3 | .0 | .1 |
| E20(2.2) Big Sister Creek at Evans Center, 2140.6 at water discharge partial-record station, at bridge on Rt. 5. | | | | | | | | | | | | | | | | | | | | | | | |
| a/July 2, 1963 | 1030 | .319 | -- | 23 | .23 | .00 | 45 | 6.8 | 83 | 8.6 | 154 | 60 | 99 | .3 | 3.7 | 422 | 141 | 15 | 675 | 7.1 | 40 | -- | .4 |
| E13(15.3) Eighteenmile Creek at North Boston, 2142 at gaging station, at bridge on Zimmerman Rd. | | | | | | | | | | | | | | | | | | | | | | | |
| a/May 7, 1963 | 1235 | 34 | 46 | 2.8 | .04 | .00 | 37 | 7.2 | 6.8 | 1.7 | 91 | 40 | 14 | .1 | 2.8 | 169 | 122 | 48 | 285 | 7.3 | 3 | .0 | .6 |
| July 2 | 1330 | 2.96 | 97 | 4.9 | .05 | .00 | 52 | 9.4 | 12 | 2.6 | 148 | 43 | 19 | .1 | 1.3 | 228 | 168 | 47 | 387 | 7.6 | 4 | .0 | .0 |
| Apr. 16, 1964 | 0710 | 45 | 38 | -- | .08 | .11 | 30 | 6.0 | 6.1 | 1.5 | 74 | 34 | 12 | -- | 3.3 | 144 | 100 | 39 | 240 | 7.8 | 3 | -- | .6 |
| E13-4(2.9) South Branch Eighteenmile Creek at Eden Valley, 2142.3 at water discharge partial-record station, at bridge 300 ft upstream from Rt. 62. | | | | | | | | | | | | | | | | | | | | | | | |
| a/May 7, 1963 | 1255 | 17 | -- | 2.1 | .02 | .00 | 33 | 6.5 | 4.4 | 1.6 | 76 | 42 | 9.2 | .1 | 1.7 | 141 | 109 | 47 | 251 | 7.5 | 4 | .0 | .0 |
| July 2 | 1115 | .40 | -- | 7.8 | .03 | .01 | 52 | 8.6 | 8.2 | 2.8 | 127 | 55 | 13 | .1 | 2.1 | 222 | 165 | 61 | 379 | 7.7 | 7 | .0 | .0 |
| E13(0.5) Eighteenmile Creek at Highland-On-the-Lake, 2142.4 at water discharge partial-record station, at bridge on Lake Shore Rd. | | | | | | | | | | | | | | | | | | | | | | | |
| May 7, 1963 | 1350 | 58 | -- | 1.2 | .07 | .00 | 41 | 8.9 | 12 | 1.8 | 95 | 55 | 22 | .1 | 2.7 | 196 | 139 | 61 | 350 | 8.2 | 6 | .1 | .0 |
| July 2 | 0840 | 3.2 | -- | 8.7 | .06 | .01 | 68 | 11 | 41 | 5.0 | 148 | 70 | 80 | .4 | 1.0 | 374 | 215 | 93 | 629 | 7.3 | 7 | .4 | .0 |

a/ Additional analyses included in table 17.
b/ Additional analyses included in table 18.
c/ Estimated.
d/ Additional analyses in table 19.

## Table 19.--Chemical analyses of major streams and tributaries (Continued)

| Date of collection | Time (hours) | Instantaneous discharge (cfs) | Percent of time flow exceeded that listed | Silica ($SiO_2$) | Iron (Fe) | Manganese (Mn) | Calcium (Ca) | Magnesium (Mg) | Sodium (Na) | Potassium (K) | Bicarbonate ($HCO_3$) | Sulfate ($SO_4$) | Chloride (Cl) | Fluoride (F) | Nitrate ($NO_3$) | Dissolved solids at 180°C | Hardness as $CaCO_3$: Calcium, magnesium | Hardness as $CaCO_3$: Non-carbonate | Specific conductance (micromhos at 25°C) | pH | Color | Alkyl benzene sulfonate (ABS) | Turbidity |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **E1-55(0.1) Beaver Meadow Creek at Java Village, at bridge on Rt. 78.** | | | | | | | | | | | | | | | | | | | | | | | |
| b/Aug. 29, 1962 | 1355 | -- | -- | 4.3 | 0.12 | 0.02 | 47 | 12 | 3.6 | 1.4 | 176 | 23 | 6.2 | 0.2 | 0.8 | 193 | 167 | 23 | 334 | 7.2 | 5 | -- | 0.9 |
| **E1(40.9) Buffalo Creek at Java Village, 2143.7 at bridge on Whitney Rd.** | | | | | | | | | | | | | | | | | | | | | | | |
| May 8, 1963 | 0715 | 22 | -- | 1.9 | .07 | .01 | 50 | 11 | 4.2 | 1.0 | 168 | 30 | 6.8 | .1 | 1.9 | 194 | 170 | 33 | 346 | 8.0 | 4 | 0.0 | .0 |
| July 5 | 1215 | 7.1 | -- | 5.0 | .06 | .01 | 53 | 11 | 4.5 | 1.4 | 180 | 33 | 6.0 | .1 | 4.6 | 212 | 177 | 30 | 356 | 7.8 | 7 | .0 | .4 |
| **E1(31.8) Buffalo Creek near Wales Hollow, 2144 at gaging station, at bridge on Marlou Rd.** | | | | | | | | | | | | | | | | | | | | | | | |
| a/May 8, 1963 | 0740 | 30 | 57 | 1.5 | .19 | .00 | 50 | 11 | 4.6 | 1.5 | 160 | 36 | 8.0 | .1 | 1.9 | 200 | 170 | 39 | 358 | 8.1 | 4 | .0 | .0 |
| July 2 | 1240 | 7.0 | 92 | 5.0 | .05 | .00 | 58 | 11 | 6.2 | 2.8 | 175 | 41 | 10 | .1 | 1.2 | 226 | 190 | 46 | 393 | 7.4 | 6 | .0 | .5 |
| **E1-30(0.3) Hunter Creek at Wales Center, at bridge on Rt. 78.** | | | | | | | | | | | | | | | | | | | | | | | |
| Aug. 29, 1962 | 1315 | -- | -- | 3.7 | .03 | .03 | 68 | 13 | 9.2 | 2.7 | 156 | 94 | 15 | .1 | .5 | 300 | 223 | 95 | 471 | 7.9 | 3 | -- | .4 |
| **E1(29.5) Buffalo Creek at Wales Center, at bridge on Rt. 20A.** | | | | | | | | | | | | | | | | | | | | | | | |
| Apr. 10, 1961 | 1810 | -- | -- | 3.1 | .15 | -- | 25 | 4.0 | 2.9 | 1.4 | 58 | 28 | 5.5 | .1 | 2.2 | 112 | 79 | 32 | 184 | 7.3 | 14 | -- | -- |
| Aug. 21 | 1000 | -- | -- | 2.9 | .14 | .0 | 53 | 12 | 4.7 | 2.0 | 176 | 41 | 5.4 | .0 | .4 | 224 | 182 | 38 | 384 | 7.6 | 4 | -- | -- |
| **E1(27.1) Buffalo Creek at Porterville, at bridge on Porterville Rd.** | | | | | | | | | | | | | | | | | | | | | | | |
| Aug. 29, 1962 | 1305 | -- | -- | 3.9 | .20 | .00 | 45 | 20 | 6.7 | 2.5 | 177 | 46 | 11 | .2 | .5 | 233 | 195 | 50 | 407 | 7.2 | 2 | -- | .0 |
| **E1(18.0) Buffalo Creek at Elma, 2144.7 at bridge on Bowen Rd.** | | | | | | | | | | | | | | | | | | | | | | | |
| b/Apr. 10, 1961 | 1845 | -- | -- | 3.1 | .21 | .0 | 27 | 4.3 | 3.1 | 1.4 | 62 | 30 | 6.5 | .0 | 2.0 | 118 | 85 | 34 | 194 | 7.2 | 14 | -- | -- |
| Aug. 21 | 1030 | -- | -- | 2.5 | .04 | .0 | 55 | 12 | 4.8 | 2.0 | 180 | 42 | 5.8 | .0 | .3 | 231 | 187 | 39 | 394 | 7.9 | 4 | -- | -- |
| May 8, 1963 | 0815 | 58 | -- | .8 | .05 | .00 | 51 | 14 | 5.4 | 1.6 | 162 | 44 | 10 | .1 | 1.7 | 216 | 185 | 52 | 380 | 7.7 | 4 | .0 | .0 |
| July 5 | 1320 | 26 | -- | 4.4 | .07 | .01 | 55 | 8.6 | 6.5 | 2.9 | 145 | 53 | 12 | .2 | 2.6 | 227 | 173 | 54 | 378 | 7.5 | 9 | .0 | .8 |
| **E1(10.4) Buffalo Creek at Gardenville, 2145 at bridge on Union Rd, 700 ft upstream from gaging station.** | | | | | | | | | | | | | | | | | | | | | | | |
| a,e/June 20, 1951 | -- | c/27 | 74 | 1.0 | .19 | -- | 52 | 11 | 3.7 | 1.6 | 155 | 47 | 5.0 | .1 | 1.4 | 218 | 175 | 48 | 339 | 7.7 | 20 | -- | -- |
| Aug. 13, 1956 | 1530 | 36 | 66 | 4.9 | .24 | .8 | 47 | 11 | 5.0 | 2.6 | 147 | 42 | 10 | .4 | .4 | 210 | 162 | 42 | 347 | 8.0 | 9 | -- | -- |
| Apr. 10, 1961 | 1900 | f/954 | 4 | 3.1 | .11 | .0 | 29 | 4.6 | 3.7 | 1.5 | 67 | 33 | 6.3 | .3 | 2.6 | 131 | 92 | 37 | 210 | 7.3 | 8 | -- | -- |
| Aug. 21 | 1200 | 32 | 71 | .9 | .04 | .0 | 52 | 12 | 5.7 | 2.1 | 165 | 44 | 7.6 | .0 | .7 | 223 | 179 | 44 | 378 | 7.8 | 9 | -- | -- |
| May 8, 1963 | 0900 | 118 | 34 | .3 | .04 | .01 | 50 | 14 | 3.9 | .9 | 160 | 37 | 13 | .1 | 1.5 | 204 | 183 | 52 | 383 | 7.6 | 5 | .0 | .0 |
| July 5 | 1030 | 21.3 | 91 | 3.9 | .05 | .01 | 51 | 8.7 | 6.5 | 3.1 | 136 | 55 | 12 | .1 | 2.5 | 218 | 163 | 52 | 359 | 7.4 | 8 | -- | .2 |
| Apr. 16, 1964 | 0810 | 122 | 32 | -- | .14 | .07 | 47 | 9.1 | 6.0 | 1.6 | g/133 | 38 | 11 | -- | -- | 212 | 155 | 42 | 334 | 8.3 | 1 | -- | .6 |
| **E1-6(23.3) Cayuga Creek at Cowlesville, at bridge on Urf Rd.** | | | | | | | | | | | | | | | | | | | | | | | |
| May 8, 1963 | 0930 | 16 | -- | 1.4 | .04 | .00 | 43 | 8.6 | 4.4 | 1.8 | 128 | 36 | 7.5 | .1 | .8 | 170 | 143 | 38 | 302 | 7.9 | 4 | .0 | .0 |
| July 5 | 1415 | 1.9 | -- | 3.8 | .03 | .01 | 58 | 11 | 11 | 2.7 | 162 | 48 | 24 | .1 | .2 | 258 | 190 | 57 | 423 | 7.8 | 4 | .0 | .6 |
| **E1-6(11.0) Cayuga Creek near Lancaster, 2150 at bridge on Bowen Rd., 700 ft upstream from gaging station.** | | | | | | | | | | | | | | | | | | | | | | | |
| June 20, 1951 | -- | 16 | 66 | 1.7 | .33 | -- | 54 | 10 | 4.5 | 3.6 | 159 | 45 | 8.0 | .1 | .8 | 222 | 176 | 46 | 352 | 8.0 | 15 | -- | -- |
| Aug. 13, 1956 | 1440 | 57 | 40 | 4.4 | .14 | .00 | 43 | 7.2 | 3.3 | 2.6 | 119 | 38 | 7.7 | .0 | .2 | 175 | 137 | 39 | 287 | 7.1 | 8 | -- | -- |
| May 8, 1963 | 1025 | 28 | 55 | .1 | .03 | .01 | 48 | 13 | 6.2 | 2.0 | 149 | 43 | 14 | .1 | 1.4 | 205 | 174 | 52 | 370 | 8.1 | 3 | .0 | .0 |
| July 5 | 1420 | 6.0 | 81 | 3.9 | .07 | .01 | 54 | 8.2 | 6.5 | 3.1 | 141 | 52 | 13 | .1 | 1.7 | 227 | 168 | 53 | 375 | 7.6 | 9 | .0 | .3 |
| Apr. 16, 1964 | 0845 | 66 | 37 | -- | .07 | .00 | 45 | 7.4 | 6.0 | 1.8 | 121 | 39 | 11 | -- | -- | 189 | 143 | 44 | 317 | 8.0 | 5 | -- | .2 |
| **E1-4-15(0.5) West Branch Cazenovia Creek near East Aurora, 2152.5 at water discharge partial-record station, at bridge on Jewett-Holmwood Rd.** | | | | | | | | | | | | | | | | | | | | | | | |
| May 8, 1963 | 1130 | 42 | -- | .7 | .03 | .00 | 36 | 6.6 | 6.1 | 1.5 | 92 | 39 | 12 | .1 | .4 | 153 | 117 | 42 | 267 | 7.6 | 2 | .0 | .0 |
| July 5 | 1110 | 4.9 | -- | 3.8 | .16 | .02 | 49 | 9.1 | 8.7 | 2.2 | 124 | 60 | 14 | .1 | .3 | 214 | 160 | 59 | 352 | 7.6 | 5 | .0 | .6 |
| Apr. 15, 1964 | 1815 | -- | -- | -- | .05 | .03 | 28 | 5.0 | 5.1 | 1.2 | 70 | 30 | 9.1 | -- | -- | 129 | 90 | 33 | 213 | 8.0 | 6 | -- | .6 |
| **E1-4-14(8.1) East Branch Cazenovia Creek at South Wales, 2153.5 at water discharge partial-record station at bridge on Darling Rd.** | | | | | | | | | | | | | | | | | | | | | | | |
| a/May 8, 1963 | 1100 | 29 | -- | 1.9 | .05 | .00 | 36 | 7.5 | 6.0 | 1.3 | 100 | 34 | 11 | .1 | 1.2 | 154 | 121 | 39 | 273 | 7.8 | 2 | .0 | .0 |
| July 2 | 0730 | 5.3 | -- | 6.3 | .03 | .00 | 45 | 8.0 | 7.1 | 1.8 | 131 | 38 | 12 | .0 | 2.0 | 199 | 146 | 38 | 330 | 7.3 | 6 | .0 | .4 |
| Apr. 15, 1964 | 1835 | 83 | -- | -- | .08 | .16 | 27 | 5.6 | 5.4 | 1.2 | 72 | 28 | 9.1 | -- | -- | 127 | 90 | 32 | 214 | 8.1 | 6 | -- | .3 |
| **E1-4(4.1) Cazenovia Creek at Ebenezer, 2155 at gaging station, at bridge on Ridge Rd.** | | | | | | | | | | | | | | | | | | | | | | | |
| a,b/June 20, 1951 | -- | 24 | 76 | 2.6 | .07 | -- | 42 | 10 | 15 | 2.0 | 104 | 51 | 28 | .2 | .8 | 234 | 146 | 60 | 362 | 7.3 | 15 | -- | -- |
| Aug. 13, 1956 | 1545 | 31 | 71 | 3.6 | .15 | .00 | 51 | 11 | 13 | 3.1 | 135 | 58 | 20 | .1 | 1.3 | 235 | 173 | 62 | 395 | 8.2 | 4 | -- | -- |
| May 8, 1963 | 1255 | 81 | 46 | .3 | .11 | .00 | 46 | 9.2 | 19 | 2.0 | 120 | 47 | 32 | .1 | 1.0 | 220 | 153 | 55 | 398 | 8.0 | 5 | .0 | .1 |
| July 2 | 1515 | 10 | 92 | 3.9 | .06 | .02 | 58 | 11 | 28 | 3.5 | h/111 | 69 | 48 | .1 | .8 | 296 | 190 | 72 | 491 | 8.8 | 7 | .1 | .7 |
| Apr. 16, 1964 | 0745 | 158 | 30 | -- | .12 | .07 | 36 | 6.4 | 12 | 1.4 | 88 | 36 | 20 | -- | -- | 181 | 116 | 44 | 293 | 7.9 | 6 | -- | .6 |

a/ Additional analyses included in table 17.
b/ Additional analyses included in table 18.
c/ Estimated.
e/ Additional analyses in table 21.
f/ Daily mean.
g/ Sample also contained 2 ppm carbonate ($CO_3$).
h/ Sample also contained 16 ppm carbonate ($CO_3$).

# Table 19.--Chemical analyses of major streams and tributaries (Continued)

| Date of collection | Time (hours) | Instantaneous discharge (cfs) | Percent of time flow exceeded that listed | Silica ($SiO_2$) | Iron (Fe) | Manganese (Mn) | Calcium (Ca) | Magnesium (Mg) | Sodium (Na) | Potassium (K) | Bicarbonate ($HCO_3$) | Sulfate ($SO_4$) | Chloride (Cl) | Fluoride (F) | Nitrate ($NO_3$) | Dissolved solids at 180°C | Hardness as $CaCO_3$ Calcium, magnesium | Hardness as $CaCO_3$ Non-carbonate | Specific conductance (micromhos at 25°C) | pH | Color | Alkyl benzene sulfonate (ABS) | Turbidity |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0158-12(100.6) Tonawanda Creek near Johnsonburg, 2164, at water discharge partial-record station, at bridge on Rt. 98. | | | | | | | | | | | | | | | | | | | | | | | |
| a/May 8, 1963 | 1400 | 17.4 | 49 | 2.2 | 0.06 | 0.01 | 32 | 18 | 2.9 | 1.0 | 150 | 26 | 5.1 | 0.1 | 1.5 | 170 | 154 | 31 | 302 | 8.2 | 4 | 0.0 | 0.0 |
| July 2 | 1310 | 7.0 | 85 | 5.2 | .03 | .01 | 47 | 13 | 3.7 | 1.4 | 174 | 27 | 5.8 | .1 | .6 | 198 | 171 | 29 | 338 | 8.1 | 6 | .0 | .0 |
| Apr. 15, 1964 | 1735 | 154 | 6 | -- | .10 | .10 | 35 | 7.2 | 2.6 | .9 | 112 | 22 | 4.0 | -- | -- | 150 | 117 | 25 | 237 | 8.1 | 5 | -- | .7 |
| 0158-12(85.6) Tonawanda Creek near Attica, 2164.6 at bridge on Stroh Rd. | | | | | | | | | | | | | | | | | | | | | | | |
| May 8, 1963 | 1430 | 50 | -- | 2.2 | .09 | .02 | 56 | 12 | 5.6 | 1.7 | 178 | 37 | 12 | .1 | 1.8 | 220 | 189 | 43 | 385 | 8.2 | 2 | .0 | .1 |
| July 2 | 1450 | 14 | -- | 5.6 | .11 | .00 | 61 | 11 | 7.2 | 2.8 | 188 | 40 | 10 | .1 | 8.2 | 253 | 197 | 43 | 411 | 7.3 | 5 | .1 | .6 |
| 0158-12-32(9.4) Little Tonawanda Creek at Linden, 2165 at gaging station at bridge in Linden. | | | | | | | | | | | | | | | | | | | | | | | |
| a/May 8, 1963 | 1455 | 9.9 | 47 | 3.1 | .14 | .00 | 52 | 10 | 4.2 | 1.3 | 172 | 28 | 6.8 | .1 | 1.2 | 196 | 171 | 30 | 348 | 8.1 | 4 | .0 | .0 |
| July 2 | 1100 | 1.84 | 76 | 6.5 | .11 | .00 | 59 | 13 | 4.9 | 1.4 | 207 | 33 | 6.4 | .1 | .2 | 234 | 201 | 31 | 420 | 7.9 | 6 | .0 | .4 |
| 0158-12(69.2) Tonawanda Creek at Batavia, 2170 at gaging station, 500 ft upstream from bridge on Walnut St. | | | | | | | | | | | | | | | | | | | | | | | |
| a/Aug. 13, 1956 | 1310 | 86 | 47 | 6.5 | .21 | .00 | 61 | 13 | 5.0 | 2.6 | 206 | 34 | 9.9 | .2 | 1.9 | 244 | 206 | 37 | 410 | 7.4 | 12 | -- | -- |
| May 8, 1963 | 1530 | 73 | 51 | 2.3 | .19 | .01 | 62 | 12 | 6.6 | 1.7 | 193 | 38 | 13 | .0 | 1.4 | 238 | 204 | 46 | 416 | 7.9 | 4 | .0 | .0 |
| July 2 | 0740 | 21 | 82 | 4.2 | .05 | .06 | 57 | 11 | 6.8 | 3.5 | 180 | 41 | 12 | .1 | 2.6 | 236 | 187 | 40 | 404 | 7.5 | 8 | .1 | .7 |
| Apr. 16, 1964 | 1355 | 179 | 30 | -- | .23 | .31 | 50 | 9.9 | 6.3 | 1.7 | 150 | 35 | 12 | -- | -- | 211 | 166 | 42 | 349 | 8.0 | 6 | -- | .8 |
| 0158-12(54.1) Tonawanda Creek at Indian Falls, 2174 at bridge on Rt. 77. | | | | | | | | | | | | | | | | | | | | | | | |
| May 8, 1963 | 1620 | 86 | -- | 1.2 | .13 | .01 | 68 | 13 | 12 | 1.7 | 205 | 41 | 24 | .2 | 3.5 | 276 | 223 | 55 | 473 | 7.5 | 6 | .1 | .4 |
| July 2 | -- | 27 | -- | 5.9 | .04 | .23 | 69 | 16 | 23 | 3.8 | 229 | 43 | 37 | .2 | 4.0 | 319 | 238 | 51 | 560 | 7.6 | 8 | .3 | .1 |
| Apr. 16, 1964 | 1220 | 257 | -- | -- | .16 | .17 | 54 | 11 | 8.8 | 1.7 | 155 | 40 | 19 | -- | -- | 249 | 180 | 52 | 388 | 7.8 | 6 | -- | .6 |
| 0158-12(46.9) Tonawanda Creek near Alabama, 2175 at gaging station, at bridge on Meadville Rd. | | | | | | | | | | | | | | | | | | | | | | | |
| a/May 8, 1963 | 1650 | 35 | 50 | 1.9 | .10 | .01 | 80 | 14 | 16 | 1.7 | 205 | 73 | 31 | .2 | 2.5 | 333 | 257 | 89 | 562 | 8.1 | 6 | .1 | .4 |
| July 2 | 1015 | 34.7 | 76 | 6.8 | .05 | .08 | 85 | 17 | 29 | 3.5 | 232 | 84 | 46 | .2 | 3.0 | 410 | 282 | 92 | 670 | 7.6 | 12 | .2 | .2 |
| Apr. 16, 1964 | 1205 | 261 | 28 | -- | .13 | .14 | 58 | 12 | 11 | 1.8 | 162 | 56 | 20 | -- | -- | 275 | 194 | 61 | 439 | 8.0 | 6 | -- | .7 |
| 9158-12-11-1(13.0) Murder Creek at Pembroke, 2177, at water discharge partial-record station, at bridge on Lake Rd. | | | | | | | | | | | | | | | | | | | | | | | |
| May 8, 1963 | 1600 | 12 | -- | 1.5 | .14 | .03 | 80 | 13 | 12 | 1.7 | 233 | 46 | 25 | .3 | .8 | 308 | 253 | 62 | 520 | 7.5 | 34 | .0 | .8 |
| July 2 | 1330 | 0 | -- | 5.0 | .10 | .12 | 84 | 22 | 30 | 3.8 | 289 | 29 | 71 | .3 | 2.1 | 414 | 300 | 63 | 697 | 7.4 | 22 | .0 | .7 |
| Apr 16, 1964 | 1320 | 46 | -- | -- | .10 | .01 | 69 | 12 | 9.0 | 2.0 | 185 | 54 | 20 | -- | -- | 292 | 222 | 70 | 454 | 7.7 | 26 | -- | 1 |
| 0158-12(19.5) Tonawanda Creek at Rapids, 2180 at gaging station, at bridge at Rapids. | | | | | | | | | | | | | | | | | | | | | | | |
| a/May 8, 1963 | 1730 | 165 | 44 | 1.5 | .15 | .01 | 102 | 16 | 12 | 1.7 | 219 | 134 | 31 | .2 | 1.8 | 437 | 321 | 141 | 675 | 7.4 | 7 | .0 | .4 |
| July 2 | 0930 | 48 | 74 | 2.5 | .09 | .00 | 146 | 22 | 29 | 2.8 | 247 | 240 | 48 | .3 | .6 | 650 | 455 | 253 | 950 | 7.4 | 8 | .1 | .5 |
| Apr. 16, 1964 | 1030 | 459 | 24 | -- | .18 | .17 | 76 | 14 | 12 | 2.0 | 169 | 92 | 16 | -- | -- | 339 | 247 | 108 | 521 | 7.6 | 15 | -- | .3 |
| 0158-12(14.1) Tonawanda Creek at Millersport, at bridge on Rts. 78 and 263. | | | | | | | | | | | | | | | | | | | | | | | |
| June 20, 1951 | -- | c/50 | -- | 4.2 | .33 | -- | 88 | 15 | 8.3 | 2.4 | 202 | 109 | 12 | .4 | 1.1 | 366 | 281 | 116 | 557 | 7.5 | 25 | -- | -- |
| 0158-12-6(2.5) Ransom Creek near Swormville, at bridge on Rt. 263. | | | | | | | | | | | | | | | | | | | | | | | |
| b/May 8, 1963 | 1800 | 19 | -- | 2.4 | .19 | .02 | 205 | 29 | 16 | 2.1 | 202 | 422 | 33 | .4 | .6 | 818 | 632 | 466 | 1,160 | 7.2 | 5 | .0 | .4 |
| July 2 | 1155 | 1.6 | -- | 3.5 | .13 | .04 | 477 | 67 | 52 | 5.3 | 148 | 1,200 | 107 | .7 | 1.2 | 2,260 | 1,470 | 1,350 | 2,360 | 7.2 | 6 | .1 | .6 |
| Apr. 16, 1964 | 1110 | 44 | -- | -- | .15 | .13 | 120 | 20 | 12 | 2.1 | 185 | 212 | 26 | -- | -- | 531 | 382 | 230 | 754 | 7.9 | 10 | -- | .2 |
| 0158-12-3(1.4) Bull Creek at Hoffman, at bridge on Town Line Rd., 1 mile south of Killean Rd. | | | | | | | | | | | | | | | | | | | | | | | |
| a,b/Apr. 10, 1961 | 2005 | -- | -- | 4.1 | .14 | .1 | 39 | 14 | 11 | 3.4 | 71 | 89 | 20 | .2 | 6.3 | 241 | 155 | 97 | 370 | 6.8 | 79 | -- | -- |
| Aug. 21 | 1345 | -- | -- | 8.8 | .06 | .0 | 64 | 22 | 23 | 3.8 | 200 | 77 | 38 | .4 | 1.7 | 354 | 250 | 86 | 564 | 8.1 | 23 | -- | -- |
| 0158-12-1(28.8) Ellicott Creek at Mill Grove, 2184.5 at bridge on Ellicott Rd., at gaging station. | | | | | | | | | | | | | | | | | | | | | | | |
| a/May 8, 1963 | 1840 | 8.6 | 53 | 1.0 | .13 | .03 | 74 | 11 | 17 | 2.1 | 204 | 49 | 32 | .3 | 1.1 | 302 | 230 | 63 | 507 | 7.7 | 9 | .1 | .4 |
| July 5 | 1125 | 2.0 | 74 | 7.1 | .06 | .03 | 80 | 15 | 59 | 5.1 | 224 | 82 | 86 | .4 | .6 | 472 | 261 | 78 | 763 | 7.5 | 14 | .7 | .4 |
| Apr. 16, 1964 | 0905 | 24 | 35 | -- | .34 | .07 | 59 | 9.6 | 12 | 2.2 | 159 | 50 | 20 | -- | -- | 255 | 187 | 56 | 419 | 7.6 | 11 | -- | .1 |
| 0158-12-1(14.1) Ellicott Creek at Williamsville, 2185 at gaging station at bridge on Wehrle Dr. | | | | | | | | | | | | | | | | | | | | | | | |
| a,b/May 8, 1963 | 1915 | 24 | 54 | 1.0 | .14 | .02 | 86 | 14 | 22 | 2.8 | 196 | 103 | 42 | .3 | 1.0 | 384 | 272 | 112 | 626 | 7.7 | 8 | .1 | .6 |
| July 2 | 1550 | .88 | 92 | 5.5 | .03 | .02 | 165 | 18 | 27 | 3.1 | 113 | 353 | 57 | .4 | .7 | 717 | 486 | 393 | 1,020 | 7.9 | 8 | .1 | .4 |
| Apr. 16, 1964 | 1005 | 77 | 30 | -- | .16 | .07 | 122 | 15 | 18 | 2.7 | 212 | 193 | 30 | -- | -- | 531 | 366 | 192 | 765 | 7.9 | 6 | -- | .4 |
| E240(0.0) Erie (Barge) Canal, at Pendleton, at bridge on Tonawanda Creek Rd. | | | | | | | | | | | | | | | | | | | | | | | |
| Dec. 6, 1960 | 1130 | -- | -- | 1.5 | .27 | .0 | 58 | 11 | 21 | 2.1 | 124 | 75 | 40 | .2 | 3.9 | 290 | 190 | 88 | 484 | 7.0 | 1 | -- | -- |

a/ Additional analyses included in table 17.
b/ Additional analyses included in table 18.
c/ Estimated.

# Table 20.--Chemical analyses of Cattaraugus Creek at Gowanda, October 1958 to September 1959

Sampling point mileage index number.--E23(17.4).
U.S. Geological Survey station number.--2135.
Point of collection.--At bridge on Rt. 39, at gaging station.
Remarks.--Additional analyses included in tables 17, 18, and 19.

Chemical analyses, in parts per million

| Date of collection | Mean discharge (cfs) | Silica ($SiO_2$) | Iron (Fe) | Calcium (Ca) | Magnesium (Mg) | Sodium (Na) | | Potassium (K) | Bicarbonate ($HCO_3$) | Sulfate ($SO_4$) | Chloride (Cl) | Fluoride (F) | Nitrate ($NO_3$) | Dissolved solids (residue at 180°C) | Hardness as $CaCO_3$: Calcium magnesium | Hardness as $CaCO_3$: Non-carbonate | Specific conductance (micromhos at 25°C) | pH | Color | Oxygen consumed: Unfiltered | Oxygen consumed: Filtered |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Oct. 1-6, 1958.. | 410 | 6.8 | 0.26 | 51 | 9.2 | 12 | | 0.6 | 146 | 42 | 16 | 0.4 | 8.8 | 237 | 165 | 46 | 393 | 7.2 | 5 | -- | 2 |
| Oct. 7.......... | 252 | -- | .16 | -- | -- | -- | | -- | 326 | -- | 142 | -- | 1.2 | -- | 252 | 0 | 952 | 6.5 | -- | -- | -- |
| Oct. 8-20....... | 288 | 6.1 | .10 | 52 | 10 | 16 | | .6 | 151 | 47 | 23 | .2 | 4.2 | 251 | 171 | 47 | 419 | 6.8 | 5 | -- | 2 |
| Oct. 21-31...... | 301 | 5.9 | .18 | 52 | 10 | 17 | | .6 | 144 | 54 | 22 | .1 | 5.8 | 253 | 171 | 53 | 426 | 6.7 | 5 | -- | 2 |
| Nov. 1-10....... | 271 | 6.6 | .12 | 53 | 9.3 | 14 | | 1.3 | 150 | 48 | 18 | .1 | 5.4 | 242 | 170 | 47 | 407 | 7.0 | 5 | -- | -- |
| Nov. 11-14...... | 622 | -- | .20 | -- | -- | | 13a/ | | 142 | 50 | 17 | -- | 5.8 | -- | 168 | 52 | 384 | 7.1 | 3 | -- | -- |
| Nov. 15-20...... | 1,441 | 7.3 | .31 | 40 | 5.8 | 4.4 | | 1.7 | 111 | 30 | 6.5 | .1 | 2.3 | 169 | 124 | 33 | 262 | 7.1 | 5 | -- | -- |
| Nov. 21-30...... | 681 | 7.2 | .16 | 42 | 6.8 | 7.7 | | 1.1 | 116 | 36 | 10 | .0 | 4.1 | 180 | 133 | 38 | 297 | 7.0 | 3 | -- | -- |
| Dec. 1-20....... | 726 | 7.0 | .07 | 41 | 7.5 | 8.5 | | 1.1 | 117 | 40 | 11 | .0 | 3.4 | 183 | 134 | 38 | 292 | 7.2 | 5 | -- | -- |
| Dec. 21-31...... | 505 | 8.8 | .04 | 46 | 8.2 | 12 | | 1.1 | 131 | 40 | 15 | .1 | 5.8 | 212 | 149 | 41 | 338 | 7.2 | 3 | -- | -- |
| Jan. 1-5, 1959.. | 574 | -- | .04 | -- | -- | | 9.9a/ | | 126 | 32 | 10 | -- | 1.7 | -- | 131 | 28 | 288 | 7.2 | 3 | -- | -- |
| Jan. 6.......... | 450 | -- | .23 | -- | -- | | 16a/ | | 123 | 64 | 29 | -- | 12 | -- | 183 | 82 | 474 | 6.8 | -- | -- | -- |
| Jan. 7-20....... | 547 | 7.5 | .06 | 43 | 7.9 | 13 | | 1.2 | 120 | 40 | 16 | .0 | 6.3 | 209 | 140 | 42 | 332 | 7.0 | 4 | 5 | 1 |
| Jan. 21-31...... | 3,534 | 13 | .08 | 36 | 5.8 | 5.4 | | 1.7 | 107 | 29 | 7.0 | .1 | 2.5 | 166 | 114 | 27 | 255 | 7.5 | 4 | 2 | 1 |
| Feb. 1.......... | 1,570 | -- | .59 | -- | -- | | 2.8a/ | | 75 | 18 | 5.6 | -- | 3.7 | -- | 85 | 24 | 166 | 7.9 | -- | -- | -- |
| Feb. 2-19....... | 1,521 | 7.2 | .15 | 38 | 6.4 | 5.9 | | 1.4 | 104 | 29 | 9.0 | .0 | 5.8 | 165 | 122 | 37 | 255 | 7.4 | 5 | -- | -- |
| Feb. 20-28...... | 647 | 7.0 | .20 | 46 | 7.6 | 9.6 | | 1.3 | 132 | 38 | 14 | .1 | 5.3 | 211 | 147 | 39 | 327 | 7.1 | 5 | -- | -- |
| Mar. 1-6........ | 1,089 | 7.5 | .47 | 46 | 7.2 | 9.6 | | 1.4 | 126 | 40 | 15 | .1 | 6.4 | 211 | 145 | 41 | 328 | 7.2 | 4 | -- | -- |
| Mar. 7-8........ | 1,660 | -- | .28 | -- | -- | | 3.4a/ | | 92 | 22 | 5.1 | -- | 3.7 | -- | 101 | 26 | 203 | 7.5 | -- | -- | -- |
| Mar. 9-10....... | 884 | -- | .07 | -- | -- | | 12a/ | | 116 | 49 | 17 | -- | 4.7 | -- | 147 | 52 | 331 | 6.9 | -- | -- | -- |
| Mar. 11-20...... | 1,363 | 9.7 | .22 | 42 | 6.9 | 8.7 | | 1.4 | 116 | 35 | 12 | .0 | 5.9 | 190 | 134 | 39 | 294 | 7.1 | 3 | -- | -- |
| Mar. 21-31...... | 2,522 | 9.1 | .35 | 34 | 5.2 | 3.8 | | 1.4 | 97 | 24 | 5.1 | .1 | 4.4 | 145 | 107 | 27 | 216 | 7.6 | 3 | -- | -- |
| Apr. 1-10....... | 3,951 | 10 | .30 | 34 | 5.1 | 3.5 | | 1.5 | 102 | 22 | 4.0 | .3 | 2.5 | 178 | 106 | 23 | 223 | 7.4 | 5 | 7 | 1 |
| Apr. 11-20...... | 916 | 6.1 | .08 | 40 | 7.1 | 6.2 | | 1.5 | 118 | 28 | 10 | .2 | 4.4 | 194 | 129 | 33 | 283 | 7.4 | 5 | 4 | 1 |
| Apr. 21-30...... | 649 | 5.1 | .06 | 44 | 8.3 | 9.2 | | 1.5 | 128 | 37 | 14 | .2 | 4.6 | 222 | 144 | 39 | 332 | 7.1 | 5 | 7 | 1 |
| May 1-31........ | 440 | 5.7 | .10 | 51 | 8.5 | 12 | | 1.7 | 140 | 40 | 18 | .1 | 5.3 | 227 | 162 | 48 | 366 | 7.2 | 5 | -- | -- |
| June 1-25....... | 226 | 6.5 | .16 | 59 | 9.9 | 18 | | 2.0 | 154 | 57 | 26 | .1 | 5.5 | 286 | 188 | 62 | 476 | 7.0 | 4 | -- | -- |
| June 26-30...... | 301 | -- | .50 | -- | -- | | 11a/ | | 151 | 37 | 16 | -- | 4.3 | -- | 164 | 41 | 370 | 7.3 | -- | -- | -- |
| July 1-12....... | 181 | 9.0 | .04 | 64 | 10 | 18 | | 1.9 | 195 | 44 | 24 | .1 | 2.4 | 278 | 201 | 41 | 483 | 6.9 | 5 | -- | -- |
| July 13......... | 123 | -- | .79 | -- | -- | | 54a/ | | 376 | 64 | 24 | -- | .0 | -- | 292 | 0 | 708 | 7.1 | -- | -- | -- |
| July 14-18...... | 117 | -- | .19 | -- | -- | | 24a/ | | 183 | 80 | 28 | -- | 3.9 | -- | 223 | 73 | 532 | 6.9 | -- | -- | -- |
| July 19-23...... | 127 | 23 | .14 | 45 | 15 | 11 | | 1.9 | 169 | 38 | 12 | .1 | 3.1 | 242 | 174 | 36 | 382 | 7.3 | 12 | -- | -- |
| July 24-26...... | 122 | -- | .06 | -- | -- | | 9.0a/ | | 178 | 65 | 16 | -- | 1.7 | -- | 218 | 72 | 461 | 6.9 | -- | -- | -- |
| July 27-31...... | 107 | -- | .29 | -- | -- | | 29a/ | | 236 | 62 | 29 | -- | .1 | -- | 236 | 43 | 567 | 7.0 | -- | -- | -- |
| Aug. 1-3........ | 95 | -- | .23 | -- | -- | | 30a/ | | 218 | 52 | 15 | -- | .5 | -- | 189 | 11 | 488 | 7.0 | -- | -- | -- |
| Aug. 4-9........ | 106 | -- | .12 | -- | -- | | 44a/ | | 293 | 64 | 37 | -- | .6 | -- | 263 | 23 | 732 | 6.9 | -- | -- | -- |
| Aug. 10-21...... | 95 | 8.0 | .25 | 62 | 12 | 23 | | 2.2 | 157 | 73 | 33 | .1 | .9 | 318 | 204 | 76 | 573 | 6.8 | 12 | -- | -- |
| Aug. 22-24...... | 118 | -- | .31 | -- | -- | | 21a/ | | 110 | 68 | 29 | -- | 6.4 | -- | 161 | 71 | 400 | 6.3 | -- | -- | -- |
| Aug. 25......... | 92 | -- | .14 | -- | -- | | 83a/ | | 248 | 108 | 84 | -- | 1.3 | -- | 256 | 53 | 801 | 6.7 | -- | -- | -- |
| Aug. 26-31...... | 261 | 6.4 | .14 | 41 | 24 | 12 | | 2.3 | 151 | 72 | 17 | .1 | 4.1 | 260 | 201 | 78 | 444 | 6.8 | 10 | -- | -- |
| Sept. 1-7....... | 142 | 12 | .12 | 58 | 12 | 12 | | 2.2 | 160 | 51 | 18 | .1 | 10 | 264 | 194 | 63 | 436 | 7.1 | 6 | -- | -- |
| Sept. 8-17...... | 82 | 6.8 | .38 | 85 | 13 | 23 | | 2.3 | 279 | 52 | 27 | .1 | .0 | 354 | 266 | 37 | 682 | 6.9 | 17 | -- | -- |
| Sept. 18-21..... | 86 | -- | .11 | -- | -- | | 9.0a/ | | 202 | 39 | 9.6 | -- | 4.9 | -- | 204 | 39 | 429 | 7.0 | -- | -- | -- |
| Sept. 22........ | 85 | -- | .25 | -- | -- | | 66a/ | | 384 | 83 | 18 | -- | .0 | -- | 284 | 0 | 810 | 7.0 | -- | -- | -- |
| Sept. 23-28..... | 88 | 6.0 | .21 | 62 | 12 | 14 | | 1.9 | 172 | 51 | 18 | .1 | 15 | 266 | 204 | 63 | 481 | 7.0 | 10 | -- | -- |
| Sept. 29-30..... | 105 | -- | .40 | -- | -- | | 51a/ | | 192 | 94 | 58 | -- | 23 | 22 | 244 | 87 | 713 | 7.4 | -- | -- | -- |
| Time-weighted average......... | 755 | 7.7 | 0.03 | 49 | 8.9 | 12 | | 1.5 | 147 | 44 | 18 | 0.1 | 4.6 | 226 | 164 | 44 | 384 | -- | 5 | -- | -- |
| Maximum observed............. | | 23 | 0.79 | 85 | 24 | 23 | 83a/ | 2.3 | 384 | 108 | 142 | 0.4 | 23 | 354 | 292 | 87 | 952 | 7.9 | 17 | -- | -- |
| Minimum observed............. | | 5.1 | .04 | 34 | 5.1 | 3.5 | 2.8a/ | .6 | 75 | 18 | 4.0 | .0 | .0 | 145 | 85 | 0 | 166 | 6.3 | 3 | -- | -- |

a/ Sodium plus potassium as sodium.

## Table 21.--Chemical analyses of Buffalo Creek at Gardenville, October 1961 to September 1962

Sampling point mileage index number.--E1(10.4).
U.S. Geological Survey station number.--2145.
Point of collection.--At bridge on Union Rd., 700 ft upstream from gaging station.
Remarks.--Additional analyses included in tables 17, 18, and 19.

Chemical analyses, in parts per million

| Date of collection | Mean discharge (cfs) | Silica ($SiO_2$) | Iron (Fe) | Calcium (Ca) | Magnesium (Mg) | Sodium (Na) | Potassium (K) | Bicarbonate ($HCO_3$) | Sulfate ($SO_4$) | Chloride (Cl) | Fluoride (F) | Nitrate ($NO_3$) | Dissolved solids (residue at 180°C) | Hardness as $CaCO_3$: Calcium, magnesium | Hardness as $CaCO_3$: Noncarbonate | Specific conductance (micromhos at 25°C) | pH | Color | Oxygen consumed: Unfiltered | Oxygen consumed: Filtered |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Oct. 1-31, 1961 | 24.8 | 7.4 | 0.05 | 50 | 15 | 6.9 | 2.4 | 168 | 53 | 10 | 0.7 | 1.0 | 238 | 187 | 49 | 392 | 7.1 | 4 | 3 | 3 |
| Nov. 1-30...... | 82.9 | 8.0 | .05 | 59 | 12 | 6.8 | 2.6 | 182 | 47 | 11 | .0 | 1.3 | 249 | 197 | 48 | 405 | 7.6 | 9 | 6 | 3 |
| Dec. 1-10...... | 144 | 8.9 | .10 | 54 | 10 | 6.4 | 2.3 | 148 | 50 | 12 | .3 | 1.9 | 231 | 176 | 71 | 373 | 7.7 | 4 | 4 | 4 |
| Dec. 11-14..... | 334 | -- | .14 | -- | -- | 7.4 a/ | | 101 | 36 | 9.0 | -- | 2.3 | -- | 119 | 36 | 273 | 7.5 | 5 | -- | -- |
| Dec. 15-31..... | 146 | 11 | .10 | 51 | 11 | 9.6 | 2.2 | 146 | 48 | 16 | .3 | 4.4 | 234 | 172 | 53 | 399 | 7.4 | 4 | -- | -- |
| Jan. 1-2, 1962. | 51.0 | -- | .36 | -- | -- | 14 a/ | | 183 | 66 | 22 | -- | 7.7 | -- | 224 | 74 | 492 | 7.4 | -- | -- | -- |
| Jan. 3-5....... | 63.3 | -- | .20 | -- | -- | 36 a/ | | 180 | 57 | 62 | -- | 13 | -- | 226 | 79 | 639 | 7.3 | -- | -- | -- |
| Jan. 6......... | 120 | -- | .25 | -- | -- | -- | -- | 155 | 45 | 18 | -- | -- | -- | 194 | 67 | 427 | 7.3 | -- | -- | -- |
| Jan. 7......... | 1,100 | -- | 2.9 | -- | -- | -- | -- | 82 | 23 | 12 | -- | -- | -- | 100 | 33 | 242 | 7.2 | -- | -- | -- |
| Jan. 8......... | 383 | -- | .64 | -- | -- | -- | -- | 180 | 76 | 48 | -- | -- | -- | 253 | 105 | 628 | 7.8 | -- | -- | -- |
| Jan. 9-26...... | 164 | 10 | .47 | 51 | 9.4 | 9.4 | 2.3 | 132 | 49 | 16 | .0 | 4.3 | 246 | 166 | 58 | 374 | 7.8 | 6 | 5 | 4 |
| Jan. 27-30..... | 631 | -- | .54 | -- | -- | 5.3 a/ | | 108 | 40 | 11 | -- | 3.7 | -- | 137 | 49 | 299 | 7.6 | -- | -- | -- |
| Jan. 31........ | 100 | -- | .41 | -- | -- | 12 a/ | | 158 | 57 | 36 | -- | 7.0 | -- | 220 | 91 | 536 | 6.8 | -- | -- | -- |
| Feb. 1-3....... | 85.3 | -- | .26 | -- | -- | 14 a/ | | 164 | 62 | 21 | -- | 8.0 | -- | 204 | 70 | 454 | 8.1 | -- | -- | -- |
| Feb. 4......... | 160 | -- | .85 | -- | -- | 249 a/ | | 152 | 54 | 412 | -- | 12 | -- | 228 | 104 | 1,580 | 6.9 | -- | -- | -- |
| Feb. 5-8....... | 449 | -- | .53 | -- | -- | .7 a/ | | 110 | 28 | 13 | -- | 2.3 | -- | 138 | 48 | 293 | 7.6 | -- | -- | -- |
| Feb. 9-24...... | 82.2 | 8.8 | .14 | 59 | 11 | 12 | 2.1 | 164 | 52 | 19 | .0 | 6.3 | 267 | 192 | 58 | 435 | 7.6 | 6 | 4 | 3 |
| Feb. 25-28..... | 768 | -- | .54 | -- | -- | 5.1 a/ | | 100 | 26 | 15 | -- | 2.4 | -- | 121 | 39 | 272 | 7.9 | -- | -- | -- |
| Mar. 1-9....... | 180 | 13 | .16 | 50 | 9.3 | 8.8 | 2.3 | 144 | 42 | 13 | .1 | 3.6 | 225 | 164 | 46 | 353 | 7.6 | 4 | -- | -- |
| Mar. 10-31..... | 517 | 8.2 | .47 | 40 | 6.7 | 6.8 | 2.0 | 108 | 35 | 13 | .1 | 4.0 | 186 | 128 | 39 | 295 | 7.3 | 12 | 10 | 3 |
| Apr. 1-30...... | 310 | 5.5 | .30 | 46 | 6.4 | 5.8 | 1.9 | 114 | 29 | 21 | .1 | 1.9 | 186 | 142 | 48 | 295 | 7.2 | 14 | 10 | 3 |
| May 1-31....... | 88.3 | 5.4 | .09 | 49 | 11 | 7.1 | 2.0 | 152 | 45 | 5.0 | .1 | .9 | 213 | 168 | 43 | 355 | 7.5 | 5 | 4 | 3 |
| June 1-30...... | 28.8 | 7.3 | .14 | 46 | 13 | 7.7 | 2.3 | 148 | 51 | 10 | .1 | 1.2 | 220 | 169 | 47 | 361 | 7.5 | 3 | 5 | 3 |
| July 1-31...... | 9.49 | 7.2 | .14 | 41 | 13 | 9.2 | 2.6 | 126 | 54 | 12 | .1 | 1.2 | 215 | 156 | 53 | 356 | 7.4 | 3 | 4 | 3 |
| Aug. 1-31...... | 11.0 | 8.0 | .05 | 40 | 13 | 8.8 | 2.5 | 124 | 56 | 12 | .1 | 1.2 | 216 | 154 | 52 | 355 | 7.4 | 3 | 5 | 3 |
| Sept. 1-30..... | 24.5 | 8.9 | .09 | 46 | 13 | 8.9 | 2.6 | 136 | 60 | 12 | .1 | 1.4 | 230 | 169 | 57 | 372 | 7.6 | 3 | 3 | 3 |
| Time-weighted average..... | 137 | 7.9 | 0.18 | 48 | 11 | 8.8 | 2.3 | 141 | 48 | 14 | 0.2 | 2.3 | 223 | 166 | 51 | 368 | -- | 6 | 5 | 3 |
| Maximum observed........... | | 13 | 2.9 | 59 | 15 | 9.6; 249a/ | 2.6 | 183 | 76 | 412 | 0.7 | 13 | 267 | 253 | 105 | 1,580 | 8.1 | 14 | 10 | 4 |
| Minimum observed........... | | 5.4 | .05 | 40 | 6.4 | 5.8; .7 | 1.9 | 82 | 23 | 5.0 | .0 | .9 | 186 | 100 | 33 | 242 | 6.9 | 3 | 3 | 3 |

a/ Sodium plus potassium as sodium.

## Table 22.--Chemical analyses of the Niagara River at Niagara Falls, October 1958 to September 1959

Sampling point mileage index number.--0158(19.6).
U.S. Geological Survey station number.--2160.
Point of collection.--At water intake for city of Niagara Falls, in west channel near Navy Island, approximately 1.6 miles offshore from Niagara Falls.

Chemical analyses, in parts per million

| Date of collection | Mean discharge (thousands cfs) | Silica ($SiO_2$) | Iron (Fe) | Calcium (Ca) | Magnesium (Mg) | Sodium (Na) | Potassium (K) | Bicarbonate ($HCO_3$) | Sulfate ($SO_4$) | Chloride (Cl) | Fluoride (F) | Nitrate ($NO_3$) | Dissolved solids (residue at 180°C) | Hardness as $CaCO_3$: Calcium, magnesium | Hardness as $CaCO_3$: Non-carbonate | Specific conductance (micromhos at 25°C) | pH | Color | Oxygen consumed: Unfiltered | Oxygen consumed: Filtered |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| October 7-15, 18-20, 1958.. | 175 | 6.6 | 0.08 | 40 | 9.0 | 9.7 | 0.5 | 125 | 23 | 22 | 0.2 | 0.0 | 188 | 137 | 35 | 311 | 7.3 | 3 | -- | 2 |
| Oct. 21-31................. | 169 | 8.5 | .07 | 38 | 8.0 | 10 | .5 | 123 | 22 | 21 | .2 | .0 | 187 | 128 | 27 | 309 | 7.4 | 3 | -- | 2 |
| Nov. 1-5,11,13-17,20....... | 167 | 7.3 | .06 | 41 | 8.2 | 9.0 | 1.0 | 125 | 24 | 22 | .3 | .0 | 185 | 136 | 34 | 312 | 7.3 | 5 | -- | -- |
| Nov. 21-25, 27-29.......... | 178 | 4.7 | .07 | 41 | 8.0 | 8.6 | 1.0 | 122 | 24 | 22 | .2 | .0 | 179 | 136 | 36 | 308 | 7.7 | 5 | -- | -- |
| Dec. 8, 9, 18, 20.......... | 163 | 4.3 | .08 | 40 | 7.8 | 11 | 1.2 | 119 | 26 | 25 | .1 | .3 | 187 | 132 | 35 | 316 | 7.4 | 3 | -- | -- |
| Dec. 21-23, 26-31.......... | 159 | 4.3 | .03 | 38 | 9.4 | 10 | 1.2 | 121 | 27 | 22 | .2 | .2 | 186 | 134 | 35 | 306 | 7.7 | 3 | -- | -- |
| Jan.6-10,12-14,18,20,1959.. | 153 | 5.4 | .03 | 39 | 8.3 | 11 | 1.3 | 125 | 22 | 23 | .4 | .2 | 197 | 132 | 29 | 311 | 7.6 | 5 | 1 | 1 |
| Jan. 21-31................. | 167 | 5.1 | .04 | 39 | 8.2 | 11 | 1.2 | 122 | 24 | 20 | .4 | .3 | 195 | 131 | 31 | 308 | 7.7 | 6 | 1 | 1 |
| Feb. 1-20.................. | 164 | 3.8 | .07 | 39 | 9.6 | 11 | 1.1 | 123 | 25 | 22 | .3 | 5.2 | 181 | 137 | 36 | 305 | 7.6 | 3 | -- | -- |
| Feb. 21-28................. | 169 | 5.6 | .06 | 40 | 9.5 | 9.8 | 1.1 | 124 | 25 | 22 | .3 | 5.8 | 186 | 139 | 38 | 305 | 7.8 | 2 | -- | -- |
| Mar. 1-12,14-15,17-20...... | 176 | 6.8 | .03 | 41 | 8.3 | 10 | 1.3 | 126 | 21 | 23 | .1 | .6 | 203 | 137 | 33 | 303 | 7.8 | 2 | -- | -- |
| Mar. 22-31................. | 175 | 4.7 | .03 | 41 | 8.3 | 9.3 | 1.3 | 122 | 24 | 22 | .1 | 1.2 | 194 | 137 | 37 | 303 | 7.6 | 2 | -- | -- |
| Apr. 1-30.................. | 186 | 4.6 | .03 | 37 | 7.5 | 9.0 | 1.3 | 110 | 24 | 20 | .1 | 1.4 | 191 | 124 | 34 | 295 | 7.8 | 3 | 5 | 2 |
| May 1-5, 7-27.............. | 196 | 5.1 | .05 | 37 | 8.0 | 9.2 | 1.3 | 113 | 22 | 22 | .1 | .2 | 187 | 126 | 33 | 293 | 7.7 | 5 | -- | -- |
| June 4-30.................. | 196 | 6.4 | .02 | 39 | 8.1 | 11 | 1.5 | 120 | 23 | 25 | .1 | .4 | 192 | 131 | 33 | 310 | 7.7 | 2 | -- | -- |
| July 1-7, 9-31............. | 188 | 7.7 | .01 | 40 | 8.0 | 11 | 1.3 | 120 | 25 | 24 | .1 | .2 | 195 | 133 | 35 | 315 | 7.5 | 2 | -- | -- |
| Aug. 1-11, 13-31........... | 182 | -- | .02 | -- | -- | 5.8a/ | | 122 | 23 | 23 | -- | .1 | -- | 144 | 44 | 315 | 7.5 | 3 | -- | -- |
| Sept. 1-22, 24-27.......... | 176 | 9.5 | .02 | 39 | 8.7 | 12 | 1.5 | 122 | 26 | 23 | .2 | .8 | 182 | 134 | 34 | 318 | 7.6 | 5 | -- | -- |
| Time-weighted average | 179 | 6.2 | 0.04 | 39 | 8.3 | 10 | 1.2 | 120 | 24 | 22 | 0.2 | 0.9 | 190 | 133 | 35 | 308 | -- | 3 | -- | -- |

a/ Sodium plus potassium as sodium

# Table 23.--Chemical analyses of the Erie (Barge) Canal at Lockport

Sampling point mileage index number.--E230(0.8).
U.S. Geological Survey station number.--2196.
Point of collection.--at Lock 35.

| Date of collection | Mean discharge (cfs) | Silica ($SiO_2$) | Iron (Fe) | Calcium (Ca) | Magnesium (Mg) | Sodium (Na) | Potassium (K) | Bicarbonate ($HCO_3$) | Sulfate ($SO_4$) | Chloride (Cl) | Fluoride (F) | Nitrate ($NO_3$) | Dissolved solids (residue at 180°C) | Hardness as $CaCO_3$: Calcium magnesium | Hardness as $CaCO_3$: Noncarbonate | Specific conductance (micromhos at 25°C) | pH | Color | Oxygen consumed: Unfiltered | Oxygen consumed: Filtered |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Chemical analyses in parts per million, water year October 1958 to September 1959** | | | | | | | | | | | | | | | | | | | | |
| Oct. 6, 1958...... | 354 | 1.2 | 0.14 | 42 | 9.1 | 12 | 1.8 | 121 | 39 | 23 | 0.3 | 1.3 | 200 | 143 | 44 | 339 | 7.1 | 3 | -- | -- |
| Nov. 6........... | 353 | .8 | .19 | 48 | 9.7 | 12 | 1.6 | 126 | 40 | 26 | .1 | 2.8 | 214 | 160 | 57 | 371 | 6.9 | 5 | -- | -- |
| Dec. 4........... | 353 | 2.4 | .42 | 58 | 11 | 14 | 2.2 | 131 | 66 | 29 | .2 | 4.1 | 267 | 190 | 82 | 432 | 6.7 | 3 | -- | -- |
| Jan. 5, 1959...... | 17 | 6.0 | .09 | 91 | 16 | 14 | 2.1 | 198 | 121 | 24 | .1 | 4.1 | 393 | 293 | 131 | 601 | 7.2 | 5 | -- | -- |
| Feb. 9........... | 5.2 | 5.9 | .21 | 66 | 13 | 14 | 2.9 | 142 | 87 | 29 | .2 | 7.1 | 318 | 218 | 102 | 494 | 7.0 | 5 | -- | -- |
| Mar. 4........... | 43 | 2.0 | .53 | 60 | 13 | 100 | 4.5 | 141 | 42 | 185 | .3 | 6.2 | 531 | 203 | 88 | 917 | 6.6 | 5 | -- | -- |
| Apr. 6........... | 51 | 4.8 | .17 | 48 | 13 | 7.3 | 3.0 | 118 | 58 | 18 | .3 | 4.4 | 276 | 174 | 77 | 375 | 7.0 | 25 | -- | -- |
| May 5............ | 98 | 2.0 | .05 | 56 | 12 | 12 | 1.8 | 130 | 68 | 24 | .0 | 2.4 | 264 | 189 | 83 | 424 | 6.9 | 6 | -- | -- |
| June 1........... | 260 | 1.1 | .10 | 48 | 9.6 | 12 | 2.1 | 125 | 47 | 26 | .0 | 2.6 | 231 | 160 | 57 | 378 | 7.0 | 6 | -- | -- |
| July 9........... | 409 | 1.5 | .10 | 48 | 9.6 | 13 | 1.8 | 120 | 50 | 26 | .3 | 3.3 | 224 | 160 | 61 | 371 | 6.8 | 3 | -- | -- |
| Aug. 3........... | 415 | 1.4 | .14 | 41 | 7.9 | 12 | 1.7 | 118 | 34 | 22 | .2 | 2.8 | 195 | 135 | 39 | 338 | 7.3 | 3 | -- | -- |
| Sept.14.......... | 394 | 1.4 | .36 | 45 | 8.1 | 13 | 1.8 | 119 | 44 | 25 | .1 | 2.2 | 207 | 146 | 49 | 363 | 7.2 | 3 | -- | -- |
| **Chemical analyses, in parts per million, water year October 1961 to September 1962** | | | | | | | | | | | | | | | | | | | | |
| Oct. 1-4,6-14,1961.. | -- | 1.7 | 0.07 | 50 | 11 | 14 | 2.1 | 126 | 48 | 32 | 0.1 | 2.9 | 241 | 170 | 67 | 409 | 7.1 | 3 | 5 | 3 |
| Oct. 15-17......... | -- | -- | .08 | -- | -- | a/11 | | 125 | 41 | 28 | -- | 1.1 | -- | 161 | 59 | 368 | 7.1 | 2 | -- | -- |
| Oct. 18-31.......... | -- | 4.1 | .07 | 50 | 10 | 14 | 2.0 | 126 | 51 | 29 | .2 | 3.1 | 236 | 166 | 63 | 397 | 7.2 | 2 | -- | -- |
| Nov. 1-18.......... | -- | 11 | .12 | 52 | 10 | 16 | 2.1 | 134 | 51 | 28 | .0 | 3.1 | 245 | 171 | 61 | 416 | 7.1 | 3 | 6 | 2 |
| Nov. 19-30......... | -- | 7.3 | .14 | 60 | 12 | 15 | 2.6 | 132 | 77 | 30 | .1 | 3.7 | 286 | 199 | 91 | 467 | 7.0 | 3 | -- | -- |
| Dec. 1-8........... | -- | 7.7 | .15 | 56 | 12 | 15 | 2.2 | 136 | 66 | 30 | .3 | 3.1 | 277 | 189 | 78 | 449 | 7.1 | 1 | -- | -- |
| Dec.9,11-24,26-31... | -- | 10 | .12 | 78 | 19 | 18 | 3.0 | 180 | 116 | 32 | .3 | 3.9 | 409 | 273 | 125 | 626 | 7.2 | 2 | 10 | 5 |
| Jan.1-6,8-13,1962... | -- | 14 | .28 | 102 | 20 | 22 | 3.0 | 191 | 167 | 38 | .1 | 1.4 | 518 | 337 | 181 | 736 | 7.6 | 9 | -- | -- |
| Jan.15-20,22,24-31.. | -- | 7.4 | .54 | 77 | 16 | 20 | 3.3 | 154 | 124 | 38 | .2 | 5.4 | 410 | 258 | 132 | 616 | 7.5 | 14 | -- | -- |
| Feb. 1-3,5.......... | -- | -- | .61 | -- | -- | a/20 | | 137 | 95 | 35 | -- | 6.1 | -- | 223 | 111 | 533 | 7.2 | -- | -- | -- |
| Feb.6-10,12-14...... | -- | 6.5 | .66 | 62 | 14 | 15 | 3.2 | 130 | 95 | 28 | .2 | 5.7 | 328 | 212 | 106 | 497 | 7.4 | 16 | -- | -- |
| Feb. 15-17, 19-21,.. 23-24, 26-28...... | -- | 6.8 | .33 | 91 | 16 | 23 | 2.8 | 182 | 145 | 36 | .2 | 5.3 | 454 | 293 | 144 | 682 | 7.5 | 14 | 18 | 5 |
| Mar. 1-11........... | -- | 7.3 | .22 | 67 | 15 | 20 | 3.0 | 142 | 100 | 35 | .0 | 5.1 | 347 | 229 | 112 | 551 | 6.7 | 14 | -- | -- |
| Mar. 12-16.......... | -- | -- | .29 | -- | -- | a/8.3 | | 80 | 40 | 16 | -- | 4.4 | -- | 115 | 50 | 280 | 7.4 | 19 | -- | -- |
| Mar. 17,19-23, 26-31............. | -- | 6.5 | .28 | 52 | 13 | 10 | 2.6 | 123 | 77 | 18 | .0 | 2.8 | 259 | 183 | 82 | 413 | 6.9 | 19 | 10 | 6 |
| Apr. 2-14, 16-21, 23-28,30.......... | -- | 7.3 | 1.1 | 59 | 13 | 11 | 2.1 | 144 | 62 | 24 | .2 | 2.9 | 293 | 201 | 83 | 438 | 7.5 | 22 | 10 | 4 |
| May 1-12,14-31...... | -- | 5.4 | .17 | 60 | 11 | 13 | 2.0 | 142 | 68 | 25 | .2 | 2.6 | 270 | 195 | 78 | 446 | 7.2 | 4 | 8 | 4 |
| June 1-30.......... | -- | 6.9 | .16 | 54 | 10 | 15 | 2.2 | 132 | 64 | 26 | .2 | 3.2 | 266 | 176 | 68 | 430 | 7.1 | 4 | 10 | 3 |
| July 2-7, 9-21, 23-31............. | -- | 5.1 | .10 | 48 | 9.6 | 15 | 1.9 | 126 | 52 | 24 | .2 | 2.7 | 242 | 160 | 56 | 397 | 7.0 | 3 | 9 | 2 |
| Aug. 1-4, 6-11, 13-25, 27-31...... | -- | 6.5 | .59 | 48 | 9.4 | 14 | 2.0 | 125 | 54 | 24 | .2 | 3.0 | 242 | 159 | 56 | 399 | 7.1 | 3 | 9 | 2 |
| Sept.1,3-15,17-30... | -- | 4.2 | .10 | 48 | 8.6 | 14 | 2.0 | 124 | 47 | 24 | .2 | 3.5 | 230 | 156 | 54 | 384 | 7.2 | 3 | 9 | 2 |
| Time-weighted average............ | | 6.8 | 0.30 | 59 | 12 | 15 | 2.3 | 139 | 74 | 28 | 0.2 | 3.4 | 294 | 197 | 83 | 465 | -- | 7 | 9 | 3 |

a/ Sodium plus potassium as sodium.

Table 24.--Cross-index of sampling point mileage index number and latitude and longitude of sampling sites reported in tables 17 to 23

| Stream and location | Sampling point mileage index number | Latitude (° ' '') | Longitude (° ' '') |
| --- | --- | --- | --- |
| Niagara R. at Niagara Falls | 0158(19.6) | 43 03 28 | 79 01 11 |
| Drainage ditch near Getzville | 0158-12-1-5a(0.6) | 43 02 04 | 78 47 27 |
| Ellicott Cr. at Williamsville (2185) | 0158-12-1(14.1) | 42 57 10 | 78 44 15 |
| Trib. to Ellicott Cr. at Mill Grove | 0158-12-1-16(0.4) | 42 56 51 | 78 33 13 |
| Ellicott Cr. at Mill Grove (2184.5) | 0158-12-1(28.8) | 42 56 09 | 78 33 06 |
| Spring Cr. at Alden | 0158-12-1-18(0.4) | 42 54 30 | 78 29 32 |
| Durkee Cr. near Alden | 0158-12-1-18-1(1.2) | 42 53 10 | 78 27 51 |
| Ellicott Cr. at Alden | 0158-12-1(35.3) | 42 54 51 | 78 29 41 |
| Ellicott Cr. near Crittenden | 0158-12-1(39.9) | 42 55 54 | 78 26 26 |
| Elevenmile Cr. near Fargo | 0158-12-1(41.4) | 42 55 21 | 78 25 27 |
| Elevenmile Cr. near Darien Center | 0158-12-1(43.1) | 42 54 02 | 78 25 24 |
| Bull Creek at Hoffman | 0158-12-3(1.4) | 43 03 56 | 78 49 23 |
| Trib. to Sawyer Cr. near St. Johnsbury | 0158-12-3-1a(0.8) | 43 05 24 | 78 51 59 |
| Trib. to Bull Cr. at Mapleton | 0158-12-3-3(0.9) | 43 07 22 | 78 48 41 |
| Bull Cr. at Mapleton | 0158-12-3(7.1) | 43 07 23 | 78 47 33 |
| Bull Cr. near Mapleton | 0158-12-3(10.0) | 43 09 17 | 78 47 21 |
| Trib. to Tonawanda Cr. near Wendelville | 0158-12-3a(2.8) | 43 06 03 | 78 47 36 |
| Trib. to Tonawanda Cr. at Wendelville | 0158-12-5(0.0) | 43 04 08 | 78 45 13 |
| Ransom Cr. near Swormville | 0158-12-6(2.5) | 43 03 10 | 78 43 42 |
| Trib. to Black Cr. at Swormville | 0158-12-6-3-1(1.3) | 43 02 48 | 78 41 49 |
| Black Cr. at Swormville | 0158-12-6-3(1.1) | 43 03 33 | 78 41 50 |
| Got Cr. near East Amherst | 0158-12-6-4(3.5) | 43 00 04 | 78 40 57 |
| Trib. to Got Cr. near Clarence Center | 0158-12-6-4a(0.1) | 43 00 01 | 78 40 33 |
| Trib. to Barge Canal near Lockport | 0158-12-7-1(3.2) | 43 08 28 | 78 40 48 |
| Mud Cr. at Millersport | 0158-12-8(0.5) | 43 05 24 | 78 41 50 |
| Trib. to Mud Cr. at Raymond | 0158-12-8-2(0.2) | 43 06 14 | 78 39 42 |
| Trib. to Mud Cr. near Rapids | 0158-12-8-4(0.4) | 43 06 33 | 78 36 11 |
| Trib. to Mud Cr. near Wolcottsville | 0158-12-8-4a(2.2) | 43 08 21 | 78 31 42 |
| Trib. to Mud Cr. at Wolcottsville | 0158-12-8-4b(0.3) | 43 06 54 | 78 31 04 |
| Mud Cr. at Wolcottsville | 0158-12-8(15.1) | 43 07 13 | 78 31 06 |
| Tonawanda Cr. at Millersport | 0158-12(14.1) | 43 05 10 | 78 41 50 |
| Tonawanda Cr. at Rapids (2180) | 0158-12(19.5) | 43 05 35 | 78 38 11 |
| Beeman Cr. near Hunts Corners | 0158-12-9(1.2) | 43 03 29 | 78 36 25 |
| Trib. to Beeman Cr. near Hunts Corners | 0158-12-9-1(2.4) | 43 01 15 | 78 36 10 |
| Trib. to Tonawanda Cr. at Sand Hill | 0158-12-10(2.0) | 43 03 35 | 78 33 23 |
| Beaver Meadow Cr. at Swifts Mills | 0158-12-11-1-1(0.8) | 43 03 36 | 78 31 48 |
| Murder Cr. at Akron | 0158-12-11-1(8.4) | 43 00 56 | 78 29 26 |
| Trib. to Murder Cr. at Pembroke | 0158-12-11-1-3a(0.6) | 42 59 47 | 78 27 12 |
| Murder Cr. at Pembroke | 0158-12-11-1(12.4) | 42 57 55 | 78 26 21 |
| Murder Cr. at Pembroke (2177) | 0158-12-11-1(13.0) | 42 59 37 | 78 26 08 |

Table 24.--Cross-index of sampling point mileage index number and latitude and longitude of sampling sites reported in tables 17 to 23 (Continued)

| Stream and location | Sampling point mileage index number | Latitude (° ' ") | Longitude (° ' ") |
|---|---|---|---|
| Murder Cr. near Pembroke | 0158-12-11-1(15.1) | 42 58 31 | 78 26 45 |
| Trib. to Murder Cr. near Corfu | 0158-12-11-1-7(2.4) | 42 58 05 | 78 22 24 |
| Murder Cr. at Sawens | 0158-12-11-1(26.9) | 42 55 15 | 78 21 16 |
| Murder Cr. at Darien | 0158-12-11-1(29.5) | 42 53 39 | 78 20 50 |
| Trib. to Ledge Cr. near Akron | 0158-12-11-2(0.5) | 43 02 04 | 78 22 24 |
| Trib. to Tonawanda Cr. near Swift Mills | 0158-12-14(0.5) | 43 04 44 | 78 28 31 |
| Tonawanda Cr. near Alabama (2175) | 0158-12(46.9) | 43 05 28 | 78 27 15 |
| Tonawanda Cr. at Indian Falls (2174) | 0158-12(54.1) | 43 01 38 | 78 23 52 |
| Trib. to Tonawanda Cr. at Indian Falls | 0158-12-20a(0.0) | 43 01 39 | 78 23 51 |
| Trib. to Tonawanda Cr. near Indian Falls | 0158-12-22a(0.1) | 43 01 10 | 78 22 00 |
| Trib. to Tonawanda Cr. at North Pembroke | 0158-12-25-1(0.3) | 43 01 16 | 78 19 44 |
| Bowen Cr. near Alexander | 0158-12-28(8.0) | 42 56 13 | 78 17 17 |
| Bowen Cr. near Alexander | 0158-12-28(11.4) | 42 54 09 | 78 17 53 |
| Tonawanda Cr. at Batavia (2170) | 0158-12(69.2) | 42 59 51 | 78 11 20 |
| Trib. to Tonawanda Cr. near North Alexander | 0158-12-31a(2.9) | 42 56 45 | 78 14 17 |
| Trib. to TonawandaCr. near Batavia | 0158-12-31b(0.2) | 42 58 11 | 78 11 17 |
| Little Tonawanda Cr. near East Alexander | 0158-12-32(1.1) | 42 57 17 | 78 11 18 |
| Trib. to Little Tonawanda Cr. near East Alexander | 0158-12-32-1(0.7) | 42 56 48 | 78 10 32 |
| Little Tonawanda Cr. at East Alexander | 0158-12-32(4.1) | 42 55 46 | 78 11 35 |
| Little Tonawanda Cr. at West Bethany | 0158-12-32(5.3) | 42 54 59 | 78 11 56 |
| Trib. to Little Tonawanda Cr. near Linden | 0158-12-32-4(0.0) | 42 54 08 | 78 10 40 |
| Little Tonawanda Cr. at Linden (2165) | 0158-12-32(9.4) | 42 52 37 | 78 09 48 |
| Middlebury Br. at West Middlebury | 0158-12-32-8(0.7) | 42 51 44 | 78 09 05 |
| Middlebury Br. near West Middlebury | 0158-12-32-8(1.8) | 42 51 34 | 78 08 26 |
| Dusing Gulf Stream near Dale | 0158-12-32-9(0.2) | 42 50 31 | 78 10 40 |
| Trib. to Little Tonawanda Cr. near Dale | 0158-12-32-14(0.3) | 42 48 30 | 78 09 59 |
| Little Tonawanda Cr. at Dale | 0158-12-32(15.2) | 42 48 57 | 78 10 04 |
| Trib. to Tonawanda Cr. at Brookville | 0158-12-33a(1.8) | 42 55 21 | 78 12 54 |
| Trib. to Tonawanda Cr. at Alexander | 0158-12-35(0.6) | 42 54 04 | 78 14 28 |
| Tonawanda Cr. near Attica (2164.6) | 0158-12(85.6) | 42 52 38 | 78 15 29 |
| Trib. to Tonawanda Cr. near Attica | 0158-12-39-1(0.1) | 42 52 33 | 78 15 29 |
| Baker Cr. at Attica | 0158-12-39-3(0.2) | 42 51 22 | 78 15 24 |
| Baker Br. near Dale | 0158-12-39-3(1.2) | 42 51 16 | 78 14 18 |
| Tannery Br. at Attica | 0158-12-41(0.1) | 42 52 11 | 78 17 05 |

Table 24.--Cross-index of sampling point mileage index number and latitude and longitude of sampling sites reported in tables 17 to 23 (Continued)

| Stream and location | Sampling point mileage index number | Latitude (° ' '') | Longitude (° ' '') |
|---|---|---|---|
| Trib. to Crow Cr. at Attica Center | 0158-12-46-2(1.9) | 42 58 52 | 78 14 06 |
| Johnson Cr. at Earls | 0158-12-59(0.2) | 42 47 32 | 78 19 18 |
| Stony Br. at Varysburg | 0158-12-66(0.1) | 42 45 35 | 78 18 41 |
| Tonawanda Cr. near Johnsonburg (2164) | 0158-12(100.6) | 42 43 05 | 78 19 18 |
| East Fork Tonawanda Cr. near North Java | 0158-12-77(0.2) | 42 42 40 | 78 19 15 |
| Tonawanda Cr. at Southburg | 0158-12(106.0) | 42 40 18 | 78 20 18 |
| Scajaquada Cr. at Lancaster | 0158-15(11.6) | 42 54 51 | 78 42 35 |
| Trib. to Scajaquada Cr. at Lancaster | 0158-15-7(0.4) | 42 55 02 | 78 41 50 |
| Cazenovia Cr. at Ebenezer (2155) | E1-4(4.1) | 42 49 47 | 78 46 33 |
| Cazenovia Cr. at Spring Brook | E1-4(10.4) | 42 49 10 | 78 41 09 |
| Tannery Br. at East Aurora | E1-4-14-4(2.0) | 42 46 03 | 78 35 46 |
| East Branch Cazenovia Cr. at South Wales (2153.5) | E1-4-14(8.1) | 42 42 12 | 78 34 50 |
| Trib. to East Branch Cazenovia Cr. at Holland | E1-4-14-20(0.2) | 42 39 02 | 78 33 02 |
| East Branch Cazenovia Cr. at Holland | E1-4-14(13.6) | 42 38 37 | 78 32 48 |
| East Branch Cazenovia Cr. at Holland | E1-4-14(13.9) | 42 38 23 | 78 32 38 |
| *Trib. to East Branch Cazenovia Cr. at Protection | E1-4-14(18.2) | 42 36 13 | 78 29 20 |
| West Branch Cazenovia Cr. near East Aurora (2152.5) | E1-4-15(0.5) | 42 45 16 | 78 39 06 |
| Trib. to West Branch Cazenovia Cr. at Taylorshire | E1-4-15-4(0.2) | 42 44 28 | 78 39 11 |
| West Branch Cazenovia Cr. at West Falls | E1-4-15(5.4) | 42 41 52 | 78 41 03 |
| West Branch Cazenovia Cr. at Colden | E1-4-15(10.5) | 42 38 38 | 78 41 05 |
| Crump Br. near Glenwood | E1-4-15-19(0.1) | 42 36 30 | 78 39 09 |
| Sprague Br. near Glenwood | E1-4-15-21(0.0) | 42 35 41 | 78 39 01 |
| West Branch Cazenovia Cr. at Footes | E1-4-15(15.3) | 42 34 56 | 78 38 40 |
| Trib. to Spencer Br. near Scotts Corners | E1-4-15-22-3(0.1) | 42 34 31 | 78 35 53 |
| Graff Br. at East Concord | E1-4-15-23(0.8) | 42 33 36 | 78 38 06 |
| Plum Bottom Cr. at Lancaster | E1-6-6(0.5) | 42 53 56 | 78 39 43 |
| Cayuga Cr. near Lancaster (2150) | E1-6(11.0) | 42 53 24 | 78 38 36 |
| Trib. to Little Buffalo Cr. near Marilla | E1-6-7-7(0.2) | 42 50 23 | 78 34 34 |
| Trib. to Little Buffalo Cr. at Marilla | E1-6-7-10(0.1) | 42 50 34 | 78 32 53 |
| Little Buffalo Cr. at Marilla | E1-6-7(9.3) | 42 50 13 | 78 32 48 |
| Trib. to Cayuga Cr. near Cowlesville | E1-6-20(0.7) | 42 51 49 | 78 29 50 |
| Trib. to Cayuga Cr. near Cowlesville | E1-6-20(2.6) | 42 51 48 | 78 27 53 |
| Cayuga Cr. near Williston | E1-6(20.9) | 42 51 28 | 78 30 19 |

* New York State Department of Health considers this to be the headwaters of East Branch Cazenovia Creek.

Table 24.--Cross-index of sampling point mileage index number and latitude and longitude of sampling sites reported in tables 17 to 23 (Continued)

| Stream and location | Sampling point mileage index number | Latitude (° ' ") | Longitude (° ' ") |
|---|---|---|---|
| Cayuga Cr. at Cowlesville | E1-6(23.3) | 42 50 28 | 78 28 14 |
| Cayuga Cr. at Folsomdale | E1-6(24.9) | 42 49 35 | 78 26 59 |
| Right Branch Cayuga Cr. at Bennington | E1-6-30(2.2) | 42 50 07 | 78 23 54 |
| French Br. at Bennington | E1-6-30-4(0.3) | 42 50 09 | 78 23 20 |
| Cayuga Cr. near Persons Corners | E1-6(30.6) | 42 47 30 | 78 23 53 |
| Cayuga Cr. at Toziers Corners | E1-6(35.4) | 42 44 16 | 78 21 29 |
| Buffalo Cr. at Gardenville (2145) | E1(10.4) | 42 51 17 | 78 45 26 |
| Buffalo Cr. at Blossom | E1(13.8) | 42 51 25 | 78 41 32 |
| Buffalo Cr. at Elma (2144.7) | E1(18.0) | 42 50 55 | 78 38 28 |
| Pond Brook at Elma | E1-15(0.0) | 42 50 54 | 78 38 26 |
| Pond Brook near East Aurora | E1-15(4.1) | 42 48 18 | 78 37 10 |
| Trib. to Buffalo Cr. near East Aurora | E1-21(0.5) | 42 47 36 | 78 35 33 |
| Trib. to Buffalo Cr. near East Aurora | E1-22(0.2) | 42 47 37 | 78 35 14 |
| Trib. to Buffalo Cr. near Wales Center | E1-26(1.6) | 42 46 03 | 78 33 17 |
| Buffalo Cr. at Porterville | E1(27.1) | 42 47 17 | 78 33 13 |
| Buffalo Cr. at Wales Center | E1(29.5) | 42 46 05 | 78 31 52 |
| Hunter Cr. near Wales Center | E1-30(0.3) | 42 45 38 | 78 31 46 |
| Hunter Cr. at Colegrave (2144.1) | E1-30(3.7) | 42 44 11 | 78 32 55 |
| Hunter Cr. near Holland | E1-30(9.8) | 42 40 56 | 78 30 36 |
| Hunter Cr. near Holland | E1-30(11.6) | 42 39 36 | 78 30 04 |
| Stony Bottom Cr. near Wales Center | E1-31(0.1) | 42 45 33 | 78 31 09 |
| Stony Bottom Cr. near Wales Center | E1-31(2.0) | 42 46 11 | 78 29 15 |
| Buffalo Cr. near Wales Hollow(2144) | E1(31.8) | 42 44 54 | 78 30 31 |
| Sheldon Cr. near Strykersville | E1-40(0.2) | 42 43 19 | 78 28 06 |
| Sheldon Cr. at Dutch Hollow | E1-40(2.7) | 42 44 13 | 78 26 28 |
| Glade Cr. at Strykersville | E1-45(0.6) | 42 42 28 | 78 27 07 |
| Glade Cr. at Strykersville | E1-45(0.8) | 42 42 31 | 78 26 56 |
| Buffalo Cr. at Java Village (2143.7) | E1(40.9) | 42 40 23 | 78 26 20 |
| Beaver Meadow Cr. at Java Village | E1-55(0.1) | 42 40 19 | 78 26 10 |
| Trib. to Beaver Meadow Cr. near Java Village | E1-55-1(0.8) | 42 40 19 | 78 24 16 |
| Beaver Meadow Cr. near Java Village | E1-55(3.2) | 42 39 57 | 78 23 22 |
| Trib. to Buffalo Cr. at Java Village | E1-58(0.0) | 42 39 47 | 78 26 25 |
| Trib. to Buffalo Cr. near Java Village | E1-58-2-3(0.4) | 42 38 19 | 78 23 19 |
| Plato Br. at Java Village | E1-59(0.0) | 42 39 40 | 78 26 26 |
| Trib. to Plato Br. near Java Village | E1-59-1-4(0.6) | 42 37 52 | 78 26 51 |
| Plato Cr. near Java Village | E1-59(0.3) | 42 39 28 | 78 26 19 |
| Buffalo Cr. near Java Village | E1(42.2) | 42 39 31 | 78 26 46 |
| Smoke Cr. at Lackawanna (2142.5) | E2(3.5) | 42 49 21 | 78 48 10 |

Table 24.--Cross-index of sampling point mileage index number and latitude and longitude of sampling sites reported in tables 17 to 23 (Continued)

| Stream and location | Sampling point mileage index number | Latitude (° ' '') | Longitude (° ' '') |
|---|---|---|---|
| South Branch Smoke Cr. near Orchard Park | E2-1(4.5) | 42 46 49 | 78 47 05 |
| Trib. to Smoke Cr. near Orchard Park | E2-2(0.6) | 42 47 20 | 78 44 25 |
| Rush Cr. near Hamburg | E3(5.3) | 42 44 55 | 78 48 36 |
| Unnamed stream near Clifton Heights | E11(1.3) | 42 43 27 | 78 54 53 |
| Eighteenmile Cr. at Highland-on-the-Lake (2142.4) | E13(0.5) | 42 42 45 | 78 58 00 |
| South Branch Eighteenmile Cr. at Eden Valley (2142.3) | E13-4(2.9) | 42 40 34 | 78 52 26 |
| South Branch Eighteenmile Cr. at Clarksburg | E13-4(11.0) | 42 37 29 | 78 50 18 |
| Trib. to South Branch Eighteenmile Cr. near New Oregon | E13-4-14(0.1) | 42 36 29 | 78 49 10 |
| South Branch Eighteenmile Cr. at New Oregon | E13-4(15.5) | 42 35 24 | 78 47 32 |
| South Branch Eighteenmile Cr. at Wyandale | E13-4(18.8) | 42 33 19 | 78 46 25 |
| Hampton Br. near Hamburg | E13-6(1.3) | 42 41 28 | 78 50 02 |
| Hampton Br. near Hamburg | E13-6(2.6) | 42 40 50 | 78 49 19 |
| Neuman Cr. at Hamburg | E13-8(0.3) | 42 42 48 | 78 48 33 |
| Neuman Cr. near Hamburg | E13-8(1.6) | 42 43 13 | 78 47 56 |
| Chestnut Ridge Drainage near North Boston | E13-9(0.1) | 42 42 03 | 78 47 34 |
| Eighteenmile Cr. at North Boston (2142) | E13(15.3) | 42 41 04 | 78 46 41 |
| Anthony Gulf Stream at Patchin | E13-27(0.5) | 42 39 32 | 78 44 55 |
| Eighteenmile Cr. at Boston | E13(20.6) | 42 37 42 | 78 44 29 |
| Eighteenmile Cr. at Fowlerville | E13(22.8) | 42 36 21 | 78 43 21 |
| Eighteenmile Cr. near Fowlerville | E13(25.5) | 42 34 45 | 78 41 43 |
| Trib. to Eighteenmile Cr. near Fowlerville | E13-57(0.2) | 42 34 59 | 78 42 07 |
| Trib. to Eighteenmile Cr. near East Concord | E13-58(1.2) | 42 34 31 | 78 40 39 |
| Pike Cr. near Highland-on-the-Lake | E15(0.5) | 42 42 02 | 79 00 09 |
| Pike Cr. at Derby | E15(3.3) | 42 40 47 | 78 58 20 |
| Big Sister Cr. at Evans Center (2140.6) | E20(2.2) | 42 39 24 | 79 02 09 |
| Rythus Cr. near Pontiac | E20-2(0.8) | 42 38 23 | 78 58 14 |
| Trib. to Rythus Cr. near Eden | E20-2a(0.3) | 42 38 09 | 78 56 21 |
| Rythus Cr. at Eden | E20-2(5.9) | 42 39 02 | 78 53 34 |
| Big Sister Cr. at North Collins | E20(12.0) | 42 35 41 | 78 57 12 |
| Hussey Gulf Stream at North Collins | E20-15(0.2) | 42 32 54 | 78 56 29 |
| Delaware Cr. near Angola (2140.4) | E21(1.5) | 42 37 46 | 79 03 15 |

Table 24.--Cross-index of sampling point mileage index number and latitude and longitude of sampling sites reported in tables 17 to 23 (Continued)

| Stream and location | Sampling point mileage index number | Latitude (° ' '') | Longitude (° ' '') |
|---|---|---|---|
| Muddy Cr. near Farnham (2140.3) | E22(1.2) | 42 36 54 | 79 04 54 |
| Cattaraugus Cr. near Irving | E23(0.0) | 42 34 07 | 79 08 10 |
| Cattaraugus Cr. at Irving | E23(1.6) | 42 34 05 | 79 06 16 |
| Big Indian Cr. near Versailles | E23-5(1.8) | 42 30 43 | 79 02 36 |
| Clear Cr. near Iroquois (2140.1) | E23-6(0.9) | 42 32 34 | 79 00 56 |
| North Branch Clear Cr. near Lawtons | E23-6-4(0.6) | 42 31 30 | 78 56 32 |
| Trib. to North Branch Clear Cr. near Langford | E23-6-4-10(0.6) | 42 33 14 | 78 50 31 |
| Clear Cr. at Bagdad | E23-6(10.2) | 42 28 58 | 78 55 07 |
| Trib. to Cattaraugus Cr. at Gowanda | E23-16(0.7) | 42 27 40 | 78 57 15 |
| Grannis Br. near Gowanda | E23-18(1.4) | 42 28 01 | 78 54 51 |
| Cattaraugus Cr. at Gowanda (2135) | E23(17.4) | 42 27 50 | 78 56 10 |
| Cattaraugs Cr. above Gowanda (2134.98) | E23(19.4) | 42 26 36 | 78 56 19 |
| South Branch Cattaraugus Cr. at Forty Bridge near Gowanda | E23-20(1.2) | 42 25 34 | 78 53 49 |
| South Branch Cattaraugus Cr. at Cattaraugus | E23-20(9.4) | 42 20 24 | 78 51 29 |
| Gowan Hollow Br. at Cattaraugus | E23-20-7(0.3) | 42 20 02 | 78 51 18 |
| Jersey Hollow Br. near Otto | E23-20-11-2(2.0) | 42 20 09 | 78 48 08 |
| Mansfield Cr. near Eddyville | E23-20-11(1.8) | 42 20 56 | 78 47 10 |
| Mansfield Cr. at Maples | E23-20-11(5.5) | 42 19 52 | 78 43 29 |
| South Branch Cattaraugus Cr. near Otto (2134.9) | E23-20(14.4) | 42 21 54 | 78 48 06 |
| Trib. to South Branch Cattaraugus Cr. near Otto | E23-20-12(0.6) | 42 22 29 | 78 48 32 |
| Trib. to South Branch Cattaraugus Cr. near Otto | E23-20-12(1.2) | 42 22 47 | 78 48 45 |
| Trib. to South Branch Cattaraugus Cr. near Otto | E23-20-12-1(1.7) | 42 23 16 | 78 49 54 |
| Trib. to South Branch Cattaraugus Cr. near Otto | E23-20-12(2.7) | 42 23 26 | 78 48 38 |
| Trib. to East Otto Cr. near East Otto | E23-20-13(1.0) | 42 23 24 | 78 43 52 |
| South Branch Cattaraugus Cr. at East Otto | E23-20(18.5) | 42 23 31 | 78 45 18 |
| Waterman Br. near Zoar Bridge, near Springville | E23-21(0.2) | 42 26 44 | 78 49 36 |
| Cattaraugus Cr. at Zoar Bridge, near Gowanda | E23(26.9) | 42 27 23 | 78 48 47 |
| Coon Br. near Zoar Bridge, near Springville | E23-25(0.3) | 42 27 40 | 78 46 50 |
| Connoisarauley Cr. at Frye Bridge, near Springville | E23-27(0.1) | 42 28 14 | 78 44 53 |
| Trib. to Connoisarauley Cr. near Ashford Hollow | E23-27-2(2.5) | 42 25 11 | 78 44 01 |

Table 24.--Cross-index of sampling point mileage index number and latitude and longitude of sampling sites reported in tables 17 to 23 (Continued)

| Stream and location | Sampling point mileage index number | Latitude (° ' ") | Longitude (° ' ") |
|---|---|---|---|
| Connaisarauley Cr. at Ashford Hollow | E23-27(6.2) | 42 24 17 | 78 41 09 |
| Trib. to Connoisarauley Cr. at Bellow Corners | E23-27-6(1.4) | 42 24 34 | 78 40 13 |
| Derby Br. at Frye Bridge, near Springville | E23-28(0.1) | 42 28 29 | 78 45 00 |
| Spooner Cr. near Scobey Bridge | E23-30(0.4) | 42 29 17 | 78 43 18 |
| Spooner Cr. near Springville | E23-30(2.3) | 42 30 31 | 78 42 26 |
| Spooner Cr. at Concord | E23-30(4.8) | 42 32 05 | 78 43 54 |
| Spring Br. at Felton Bridge near Springville | E23-32(0.1) | 42 28 53 | 78 41 05 |
| Spring Br. at Springville | E23-32(2.6) | 42 30 45 | 78 39 48 |
| Spring Br. at Springville | E23-32(3.3) | 42 31 09 | 78 39 50 |
| Spring Br. near Springville | E23-32(4.0) | 42 31 50 | 78 39 31 |
| Buttermilk Cr. at Edies Siding | E23-33(0.4) | 42 28 51 | 78 40 32 |
| Buttermilk Cr. near Springville (2134.5) | E23-33(1.5) | 42 28 21 | 78 39 54 |
| Gooseneck Cr. at Riceville | E23-33-5(1.0) | 42 26 34 | 78 36 51 |
| Buttermilk Cr. at Riceville Station | E23-33(5.0) | 42 26 02 | 78 37 48 |
| Buttermilk Cr. at West Valley | E23-33(7.4) | 42 24 14 | 78 36 44 |
| Trib. to Cattaraugus Cr. near Riceville | E23-36(2.7) | 42 28 47 | 78 35 54 |
| Cattaraugus Cr. near Springville | E23(46.9) | 42 30 51 | 78 34 57 |
| Hyler Cr. near Sardinia | E23-42(0.0) | 42 30 47 | 78 34 27 |
| Hyler Cr. near Sardinia | E23-42(1.8) | 42 31 45 | 78 34 54 |
| Dresser Cr. near Sardinia | E23-43(0.2) | 42 30 48 | 78 34 05 |
| Dresser Cr. near Sardinia | E23-43(1.7) | 42 31 47 | 78 33 37 |
| King Br. near Sardinia | E23-45(0.2) | 42 30 41 | 78 33 06 |
| Elton Cr. at The Forks (2134.2) | E23-48 | 42 31 05 | 78 31 00 |
| Trib. to Stony Cr. near McKinstry Hollow | E23-48-1-1(0.1) | 42 29 02 | 78 32 36 |
| Lime Lake Outlet at Delevan | E23-48-3(0.4) | 42 29 20 | 78 29 12 |
| Trib. to Lime Lake Outlet at Delevan | E23-48-3-1(0.3) | 42 28 56 | 78 29 16 |
| Lime Lake Outlet at Delevan | E23-48-3(1.3) | 42 28 38 | 78 28 53 |
| Lime Lake Outlet at Lime Lake | E23-48-3(4.8) | 42 26 07 | 78 28 34 |
| Elton Cr. at Delevan | E23-48(3.6) | 42 29 21 | 78 28 58 |
| Trib. to Elton Cr. near Elton | E23-48-4-1(0.7) | 42 28 41 | 78 25 31 |
| Trib. to Elton Cr. at Elton | E23-48-6(0.1) | 42 27 04 | 78 25 26 |
| Elton Cr. at Elton | E23-48(8.1) | 42 26 56 | 78 25 44 |
| Trib. to Beaver Lake near Farmersville Station | E23-48-9(0.5) | 42 27 10 | 78 23 13 |

Table 24.--Cross-index of sampling point mileage index number and latitude and longitude of sampling sites reported in tables 17 to 23 (Continued)

| Stream and location | Sampling point mileage index number | Latitude (° ' '') | Longitude (° ' '') |
|---|---|---|---|
| Elton Cr. near Farmersville Station | E23-48(13.0) | 42 25 18 | 78 22 26 |
| Elton Cr. at Farmersville Station | E23-48(14.0) | 42 25 29 | 78 21 57 |
| Cattaraugus Cr. at Sardinia | E23(51.9) | 42 31 39 | 78 30 31 |
| Hosmer Br. at Sardinia | E23-50(0.2) | 42 31 40 | 78 30 29 |
| Hosmer Br. at Sardinia | E23-50(1.0) | 42 32 28 | 78 30 16 |
| *Dry Cr. near Sardinia | E23-50-3-1(0.8) | 42 34 06 | 78 31 56 |
| Hosmer Br. at Chaffee | E23-50(1.7) | 42 34 02 | 78 29 45 |
| Trib. to Cattaraugus Cr. at Cheery Tavern near Yorkshire | E23-51(0.8) | 42 32 28 | 78 28 51 |
| Cattaraugus Cr. near Arcade (2134.1) | E23(54.7) | 42 32 13 | 78 27 28 |
| Trib. to Clear Cr. at Sandusky | E23-56-9(0.6) | 42 29 57 | 78 22 29 |
| Skim Lake Outlet at Sandusky | E23-56-11(0.1) | 42 29 24 | 78 22 47 |
| Clear Cr. at Sandusky | E23-56(4.7) | 42 29 16 | 78 22 07 |
| Clear Cr. near Freedom | E23-56(6.0) | 42 28 50 | 78 20 50 |
| Trib. to Clear Cr. at Freedom | E23-56-15(0.7) | 42 29 05 | 78 19 25 |
| Clear Cr. at Freedom | E23-56(7.5) | 42 29 18 | 78 19 16 |
| Cattaraugus Cr. at Arcade | E23(56.7) | 42 32 09 | 78 25 14 |
| Spring Br. at East Arcade | E23-67(0.7) | 42 33 45 | 78 20 36 |
| Cattaraugus Cr. at East Arcade | E23(61.7) | 42 34 11 | 78 20 47 |
| Trib. to Cattaraugus Cr. near East Arcade | E23-69(0.3) | 42 36 56 | 78 19 59 |
| Cattaraugus Cr. at East Java | E23(65.7) | 42 37 20 | 78 20 28 |
| Erie (Barge) Canal at Lock 35, at Lockport | E230(0.8) | 43 10 12 | 78 41 38 |
| Erie (Barge) Canal at Pendleton | E240(0.0) | 42 05 06 | 78 44 02 |

* New York State Department of Health considers this to be a tributary to Dry Creek.